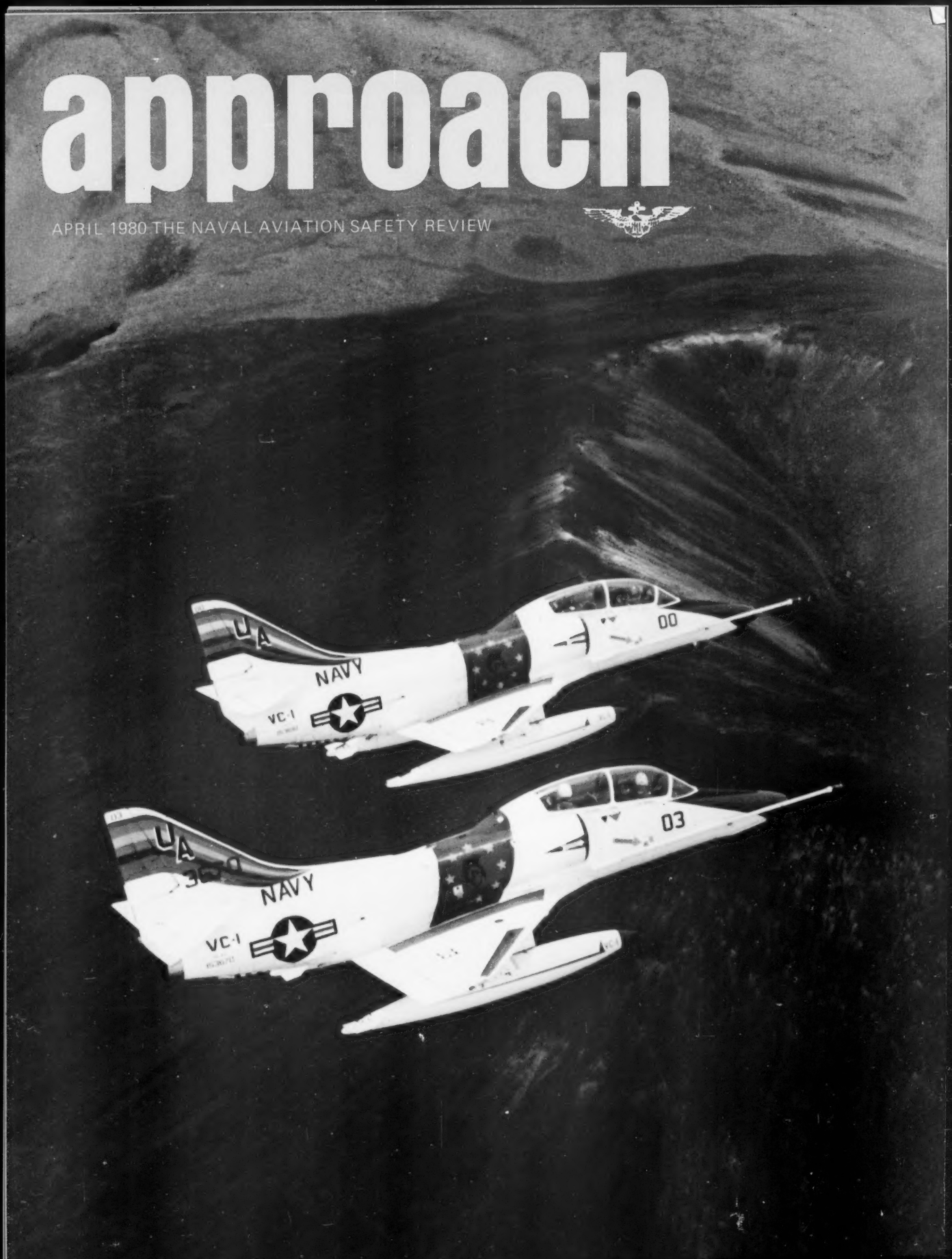
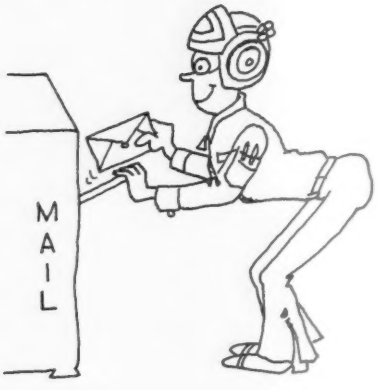
approach

APRIL 1980 THE NAVAL AVIATION SAFETY REVIEW



With YOU in mind!



APPROACH conducted a readership survey at the end of 1979 and came up with, among many other useful items, one rather predictable result. The survey indicated that *personal lessons learned* are the most popular types of articles with you, our readers. It has generally been the philosophy here at APPROACH that you would rather read what **really** happened to someone during his ejection, mishap, etc. than some *expert's* account of what he thinks will happen during the same evolution. It is also obvious that you are in the position to tell us what is really happening in the Fleet in regard to safety.

These points are important to you for two reasons. First, that APPROACH is edited, designed, and published **with you in mind!** Its sole purpose is to provide you with information and ideas to help make your life safer and longer. Second, it is you who must provide the personal accounts of incidents, mishaps, etc. in order for us to publish them for use in the Fleet.

It appears that many of you feel the material in APPROACH is written by a group of select authors whom the editor periodically "taps" for contributions, or that we are only interested in material from safety officers. Nothing could be further from the truth! Many of the articles you read in these pages are received, unsolicited, directly from the individual authors. Some of the articles are personal lessons learned, some are specific safety suggestions, some are simply ideas or philosophies – all are potentially valuable to someone in our audience.

If you are a pilot, NFO, aircrewman, flight surgeon, or air traffic controller, you have undoubtedly had some experience that made you think there had to be a better way to operate. You probably didn't write this experience down and submit it to APPROACH for one of two reasons: you were unaware that we are highly interested in your idea or experience (no matter how roughly written); or, you were too lazy to take the time! You may immediately dispense with the first of these thoughts, because **we are interested**. In regard to the second problem, only **you** can overcome that!

If you're convinced by now that we do want your experiences and ideas, sit down and type or print what you have to say (double-spaced, preferably) and mail it to: Editor – APPROACH, NAVSAFECEN (Code 72), NAS Norfolk, VA 23511. You may submit your article via your safety officer and/or CO, or send it direct. Please include your name and rank/rate (names will be withheld from publication on request), your complete address, and your Autovon phone number.

For any other questions, or to discuss the applicability of a particular article, please contact the editor at the address above, or by calling (804) 444-1321, Autovon 690-1321, or FTS 954-1321.

Vol. 25 No. 10

approach

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The photograph of the two TA-4 Skyhawks on this month's cover was submitted by VC-1, NAS Barbers Point, Hawaii.

Ejection Planning 2
By LCDR W. S. Donaldson. Know what your ejection seat can and cannot do for you.

Which Way Is Right? 10
By CDR V. M. Voge, MC. Second in our series on vertigo and spatial disorientation.

Profile of a Mishap 18
A look at some of the insidious pressures behind our operations.

The Right Way, the Wrong Way, and . . . 6
By LCDR Clif Scholl

Who's in Control? 8
By LCDR W. S. Donaldson

Bravo Zulu 9

New Helo Flight Trainer 12
By SSgt Cal Openshaw, USMC

Anymouse 14

Birds Do More Than Sing! 16
By LT R. E. Edmonson

Prevent the Preventable 22

The Flight Engineer 24
By LCDR N. Ryan

But I Can Hack It! 26
By LCDR C. C. Alton

Anticipation or Assumption? 27

Airfield Profile No. 11 – MCAS Beaufort (NBC) 28
By Capt J. Pendzick, USMC

Power Settling vs. Settling With Power 30
By LCDR R. Prestridge

Letters 32

RADM W. B. Warwick, Commander, Naval Safety Center

CAPT C. L. McGathy, Director, Aviation Safety Programs

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Ejection

planning

By LCDR W. S. Donaldson
VA-65

WE all know the old saying, "Aviation consists of hours of utter boredom interrupted by moments of stark terror." There are very few hours of boredom in naval TACAIR flying, but the moments of stark terror do exist. It is for the worst of these moments that CNO has provided us with ejection seats. Unfortunately, many naval aircrews take the 0/0 seat for granted. You would think that as ejection seats evolved, becoming more reliable and of higher performance, that ejection fatalities would have dropped accordingly. This is simply not the case. Many words have been written in an attempt to explain why the opposite case exists for some aircraft and seat combinations. There are examples of seats being upgraded and fatality rates increasing, at least temporarily. After accounting for a rise in seat malfunction rates experienced in the past several years, crewmember ignorance or indifference remains the most probable cause factor in high fatality rates.

Many are not prepared when their emergencies occur. They are not mentally ready to face adverse flight conditions with preplanned actions, and simply don't know what the seats can or cannot do for them. Relying on the system to pull their collective bacon out of the fire, under conditions which the seats were not designed to handle, contributes to an annual 15 to 20 percent fatality rate. Let's look first at what a 0/0 seat really is, then we can discuss some statistics concerning actual performance of a specific seat and develop some ejection guidelines.

First of all, using the term "0/0" to describe low-altitude ejection seats is a misnomer. What we really have is a 0/0,0,0,0 seat. Disregarding those last three unexpressed zeros has cost many a life. The first two are 0 altitude and 0 airspeed, but to meet seat manufacturers' design parameters, the last three should also be there – *0 pitch, 0 roll,* and *0 sink rate.*

An example of each of the three conditions which have unfortunately resulted in fatal injuries might point out the real world consequences of forgetting the last three parameters:

- The aircraft traps aboard ship, loses its brakes and rolls off the angle after coming out of the arresting gear too fast. The pilot ejects after the nosewheel drops off the angle. Fatal. Why? Because the pitch angle was minus 15 degrees (nose-low) at ejection – well outside design limits.
- Another example comes to mind of an A-4 landing at Homeplate in an adverse crosswind condition. The aircraft leaves the left edge of the runway at 90+ knots, and the left mainmount collapses. The aircraft begins to ground-

loop back across the runway, with the right mainmount and nose gear still down and locked. Pilot ejects – fatal injury. Why? The left-wing-down attitude at ejection was outside design limits.

• Finally, the gent who is nursing his single-seat bird back to the NAS with a sick engine. He flys a low precautionary approach with gradually decreasing power available from the failing mill. In a last ditch effort to make the runway, he attempts to stretch the glide by holding the nose up and allowing airspeed to bleed off. At 200 feet AGL, the engine fails. He hesitates for a few seconds and ejects, descending through 50 feet AGL at a 25-foot-per-second sink rate. Result? You guessed it.

Versions of these scenarios have unfortunately been played over more than once, with minor changes through the years. Regardless of how good the seat is, the statistics remain nearly constant – about 15 to 20 percent fatal. A study conducted from data compiled over a 5-year period indicates the hazardous ejection situation encountered most frequently is in the takeoff or landing environment (shore).

About 500 times a year, TACAIR naval aviators experience problems in the landing or takeoff phases of flight in the shore environment. The human errors that occur can be broken down into two categories: (1) not ejecting promptly while still in the envelope; and (2) ejecting after the aircraft makes contact with the deck or as it's leaving the prepared runway surface out of control.

Statistics show that once you are on deck and don't eject, your survival chances are significantly greater than if you decide to exercise the zero altitude option of the seat. In takeoff accidents where the aircraft remains on the ground, if you stay with the aircraft you can expect a 96 percent survival chance. If you eject, expect an 83 percent chance of survival. The difference in landing accidents is even greater. Once contact is made with the ground, of those who don't eject, 99 percent make it; of those who do, only 84 percent live. The difference is significant. In a 5-year period, in actual numbers, 10 or 11 of 12 victims of fatal ejections might still be with us had they stayed with the aircraft. Remember a few statistics: almost 70 percent of fatal ejections result from attempts below 500 feet; the median altitude for all ejections is about 1100 feet and 180 knots airspeed.

Let's look at a specific aircraft/seat combination. The A-6/Martin Baker GRU-7 combination is one of the best. However, primarily because of human error, we are still experiencing fatalities. Let's specifically look at the ground level/zero speed option. Fire is about the only hazard that comes to mind as a valid reason to eject from an aircraft at rest. Is it a good solution to the problem at hand? If you are riding the GRU-7 seat, the answer is "maybe"! It

depends on your size. The center of gravity of the seat/man combination radically changes the ballistic performance. If you are in the 5th percentile (small guy) and everything works as advertised, after a vertical trajectory you will land only 66 feet outboard of the ejection point (no wind) with a total flight time of 17.8 seconds and an open chute at 209 feet AGL. If you are in the 95th percentile (big guy), you will land 180 feet forward and 20 feet outboard of the ejection point after only 7.3 seconds of flight time, with an open chute at 65 feet AGL. The small guy may very well land back in the fire. The big guy will clear the fire, but has a much smaller margin of safety for a good chute.

Let's look at how pitch, roll, and sink rate affect the Martin Baker GRU-7:

• **Pitch**. The GRU-7 is very sensitive to pitch in the low-altitude, zero speed environment. A 5-degree nosedown attitude requires 50 feet AGL for a successful attempt. Fifteen degrees nose-down requires 160 feet AGL to be successful. Obviously, any forward speed adversely affects performance because you are adding a sink

component with the pitch component. In a 450-knot, 45-degree dive angle, the seat must leave the aircraft by 1125 feet AGL.

- **Roll** is somewhat less sensitive. (Zero speed, zero sink conditions.) A 10-degree wingdown requires 15 feet AGL, 45-degree wingdown – 85 feet AGL, 90-degree wingdown – 370 feet, and 180-degree wingdown (inverted) requires 625 feet. Forward speed in this case improves performance. A 500-knot inverted ejection can be survived from 390 feet AGL with a zero sink rate.
- **Sink rate** is always an adverse factor. The GRU-7 will get you out down to 0 feet altitude at normal landing sink rates. In a stalled condition, wings level at 2000 feet/minute sink rate requires 125 feet AGL, 3000 feet/minute requires 225 feet AGL, and 4000 feet/minute requires 325 feet AGL when the seat leaves the aircraft. An interesting note here is the fact that many aircraft, when landing on the mainmounts on hard surfaces, will maintain structural integrity at sink rates far above those normally experienced by the naval aviator. A lightweight A-6 would most likely hold together up to 2000 feet/minute, or three times that of a normal carrier approach.

A few rules of thumb might keep you from being the one guy in five who doesn't survive his ejection:

- Know your seat performance cold.
- In *extremis* at low altitude, out of control, don't hesitate – get out fast while in parameters.
- When in control, convert excess airspeed to a wings level climbing vector, then eject.
- In *extremis* on deck, landing roll, or takeoff roll, throttles off (put the fire out), and remember the survival percentages before you eject.

Be a survivor. Use the ejection system professionally.

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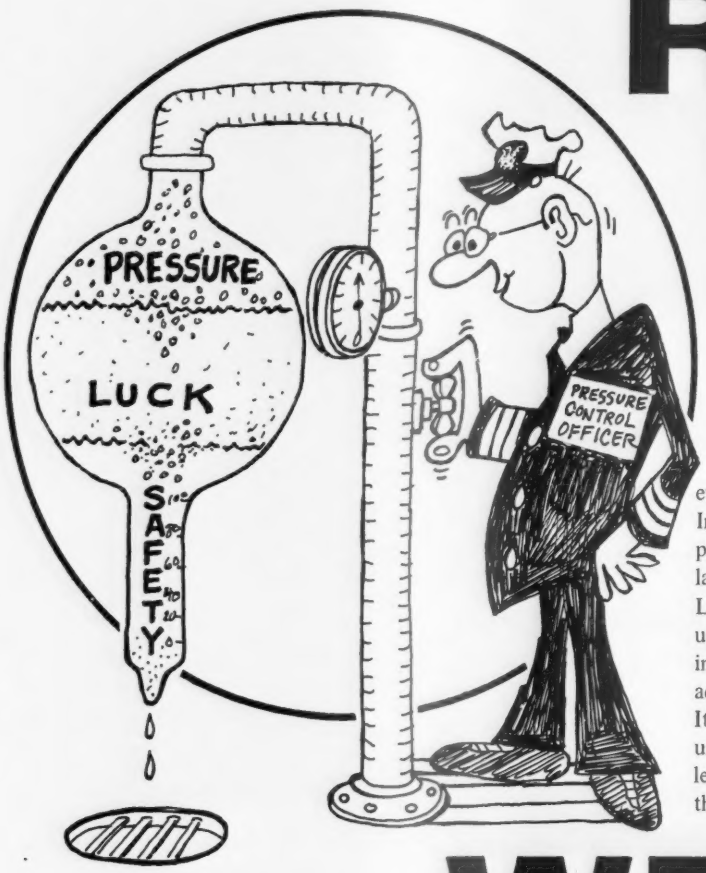
THE RIGHT WAY, THE



SOONER or later everyone hears the title phrase and eventually attaches his own significance to its meaning. In my mind, the quote makes reference to a couple of philosophies, i.e. – standardization, compromise. Of late, I've added one more and different element – LUCK. Luck can be good or bad, but what it can't be is planned upon. It's either there or it isn't. I believe it was with that in mind that we changed the terminology of aircraft accident, because accident is synonymous with luck. It just happens for no particular reason and is, therefore, unpreventable. Incidents and mishaps, on the other hand, lend themselves to the attachment of culpability and, therefore, can be dealt with in terms of prevention.

WRONG WAY, AND...

By LCDR Clif Scholl
VAW-122

This leads up to a discussion of the OCT '79 APPROACH article, "Want to Buy a Farm?," in which a helo driver describes an occurrence which almost ran an H-3 and a *Whale* together. The conclusion to the article relates several preventive measures which might have been taken to eliminate the entire situation. That none of these measures was employed and that an aircraft mishap did not occur is an accident – luck. Basically the whole story revolves around pressure: the air boss pressuring a helo to lift off so that an approaching A-3 could land; the helo pilot, responding to the pressure, getting airborne disoriented; and the subsequent near-miss when the A-3, on a waveoff, passed the helo close aboard.

It amazed me for a moment that none of the preventive measures referred to at the conclusion of the story mentioned the pressure exerted by the air boss in his attempt to clear the deck of the helo and catch the A-3. His questions and comments didn't help: *"What's your problem?"* (when the helo still had tiedown chains attached); *"That's the slowest I've seen your crew move!"* (at night, on a carrier, with the helo turning, during a hot-pump); *"Lift off! Lift off!"; "Keep it low!"; "Get lower, get down, get down!"* The crews were lucky, really lucky.

Pressure, its administration and application, is becoming the means of doing more with less. Cutting the existing margins of time and space to the minimum begins to decrease the odds in favor of success to 50/50. Pressing on as the odds decrease reduces the problem to a confrontation of potential disaster versus luck. The jocular quote, "Safety is a matter of luck," begins to take on the appearance of a truism when considered in this *modus operandi.* Consequently, if you want to take the luck out of the safety equation, you have to increase the odds in your favor by reducing or managing pressure. Naval aviation is not, and will never be, as safe as commercial aviation. We shouldn't expect it to be for a variety of good, military reasons. What we should expect, and demand, is that it be as safe as it can be by controlling the pressures which constrict the margins of safety.

The APPROACH article mentioned earlier is not unique. In fact, it describes the environment in which we operate from the single sortie to the broadest concept of operations. Indeed, it's a model for success in many cases. The avoidance of disaster by luck is as much a contributor to success as if accomplished through the most meticulous plan. The name of the game is to drive the situation from beneath in order to put the go/no-go decision on a sufficiently broad number of shoulders so that the consequences can be absorbed without impairing advancement. In so doing we encapsulate our whole effort in a pressure cooker environment and **try** to blow the top off. The end products are twofold: first is frustration, because we do things we know are less safe than they need to be (but the "why" to the question is more than a little elusive); second is the repetition of the entire *modus operandi.* By existing in an overpressure situation continuously, we suppress initiative and expansion to the point where little can compete with the current "successful" philosophy.

How do we change? Easy – just take all of the negative statements about the way we're doing things and make them positive – right? In some ways, yes, that is a method, and such analyses should be conducted periodically. The results, to the extent that they can be, should be put into practice. Another solution, however, more in line with this discussion, lies in the reduction of pressure to the point where we begin to emerge from crisis management and reactive decisionmaking. Pressure is necessary to ensure productivity and to prevent inefficiency due to underutilization. The management of that pressure is the point we seem to have let escape us. To all appearances, there does not seem to be a *pressure control officer* onboard. In actuality we are all *pressure control officers* just as we're all *safety officers,* and so the two ideas come together. There is a right way, a wrong way, and another way – a compromise which weighs and measures pressure so that the common sense and good judgment of everyone can be exercised. The bottom line is: the more pressure you apply, the more luck will be necessary to keep the evolution safe.

What are the acceptable levels of pressure and luck in a given circumstance? It is my observation that this is what we're asking the broad number of shoulders to tell us. Will we be told? NO! The operational commanders and the bureaucrats expect us to be able to determine that for ourselves. Initiative, expansion, and even risk on the part of each of us will be the ultimate requirement when it comes to managing pressure.

Pressing on blindly with a stupid idea simply because no one has told you to stop is an error we can no longer tolerate. Question, plan, manage, and critique before you execute yourself into deep "kim shi." It's all common sense and good judgment, but our trouble is we force ourselves to execute in the air, not on the deck before the pressure level increases. If you can feel the pressure on the deck, you're gonna love it in the air! ◄

Who's in Control?

By LCDR W. S. Donaldson
VA-65

A SECTION of F-4s, one US-2B, and last but not least, a tower supervisor were the principles in this incident. The F-4 leader was a highly experienced and aggressive aviator. The US-2B plane commander was also an experienced aviator with over 400 hours and 50 carrier landings in the C-1A, plus over 2000 hours of single-engine jet time. The combined flying experience of these pilots added up to 20 years. Both flights proceeded as planned until the F-4 leader lost his radio.

The F-4 wingman took the lead and returned to NAS for a normal left break with the former leader on the starboard wing. Meanwhile, the S-2 crew was proceeding back to Homeplate, had contacted Approach, and was in the process of shooting a practice GCA to a full stop on the right runway. Somewhere inside of 4 miles, the F-4 section passed overhead the S-2, which was already dirty and under the GCA final controller. The F-4 section broke at midfield, and having informed the tower of his wingman's NORDO status, the new lead requested a touch-and-go to the same runway on which the wingman would be cleared for full stop – in compliance with squadron SOP. He also requested that the tower clear the wingman on guard because the wingman had an operable guard receiver.

The tower complied with the F-4 leader's request, cleared him for a touch-and-go on the **left** runway, and broadcast clearance to the wingman to full stop on the **left**. The S-2 pilot, hearing the guard transmission and seeing the lead F-4 on final for the left runway, went back to his instrument scan to complete his precision approach on the right.

The first indication that the S-2 pilot had of an impending problem was the cessation of heretofore continuous glide slope and lineup information by the final controller. Sensing something in his peripheral vision, the S-2 pilot glanced left only to see an F-4, 35 degrees left wing down, on the beam, rapidly closing the S-2. The S-2 pilot jinked hard right and the pilot added power to stop his sink rate. The F-4's superior speed caused him to very quickly overtake and pass the slower S-2 on the inside of the turn. The F-4 NORDO pilot continued to a full stop on the right **(wrong)** runway.

The closest point of approach was about 150 feet of lateral separation and zero altitude separation. The near-miss occurred at 200 feet AGL, just a half-mile from touchdown. The GCA operator, after a pregnant pause and a what-the-hell transmission from the S-2 pilot, transmitted, "The tower directs a waveoff." Too late! To make things worse, the shaken and highly irate S-2 pilot demanded the F-4 driver's squadron, side number, and name. He then allowed his aircraft to fly at a low airspeed into a cocked-up attitude, which he finally recognized at about 300 feet over the station admin building. He went to climb power and then made a normal (albeit paranoid) visual approach to a full stop.

Who was at fault? All can share some of it. The primary cause was the failure of the F-4 NORDO to conform to squadron SOP. Later, when asked why in the world he chose the right **(wrong)** runway after his wingman landed left, he was at a loss for an explanation. He simply didn't know! Psychologists have a name for it, but we laymen would call it daydreaming or complacency. Have you ever acknowledged clearance to land on one dual runway and caught yourself setting up for the other one?

Let's look at everyone involved, after granting the human error on the part of the F-4 NORDO pilot. After all, the only reason we have air control facilities is to prevent midair collisions and assist aircrews in instrument flight conditions. The tower supervisor (newly qualified) failed to recognize the impending midair until very late, then failed to use the emergency communication capability at hand to warn both aircrews. He did attempt to pass a waveoff via the GCA controller to the S-2, but it was too late and not specific enough. He didn't recommend a direction. A normal waveoff straight ahead or to the left could have been fatal.

How about the S-2 pilot? Well, he failed to keep track of the second (NORDO) F-4 in the pattern and, after the near-miss, violated the cardinal rule in aviation –**FLY YOUR AIRCRAFT FIRST.**

Readers can see that all three key individuals involved failed to maintain control of their aircraft or traffic pattern, primarily through a breakdown in mental discipline. The next time you find yourself feeling so comfortable in the landing pattern that you are thinking about things on the ground, or get mad and preoccupied, ask yourself, "Who's in control?" In this incident, a minimum of six persons were directly involved with the near-miss and the prevention of same. Luck and reflex action on the part of the S-2 pilot should be credited with the save, as the F-4 was sighted by the S-2 pilot only 3 or 4 seconds prior to the closest point of approach.

This type of midair (between VFR and IFR controlled traffic) is all too common and is always preventable. Remember, the IFR crew in VMC shares the "see and avoid" responsibility with the VFR crew. Also, in civil, commercial, and military aviation, the most hazardous midair potential occurs in the approach to landing phase of flight. Be professional, and don't relinquish control during this critical phase. It could radically shorten your career.

BRAVO ZULU

ABHAN Curtis B. Fox

AT approximately 0900 on the morning of 15 January 1979, onboard the USS MIDWAY (CV 41), a sure tragedy was averted by the quick thinking and reaction of ABHAN Curtis B. Fox, USN. The MIDWAY was in the process of launching aircraft when a taxiing A-6 became impeded in its movement by the No. 3 arresting gear cable. A maintenanceman, working on the deck at that time, was caught in the extreme turbulence of the *Intruder's* twin jet exhausts and was blown towards the flight deck edge. ABHAN Fox, acting as a flight deck director, with complete disregard for his own personal safety, and fully aware of the personal dangers involved, unhesitatingly left the relative shelter of a parked aircraft and *tackled* the now incapacitated shipmate just before he would have been blown over the deck edge! Although Airman Fox received injuries to himself as a result of his actions, he maintained a grip on his shipmate and successfully attracted the attention of other flight deck personnel who in turn signaled the pilot of the A-6 to retard his engines.

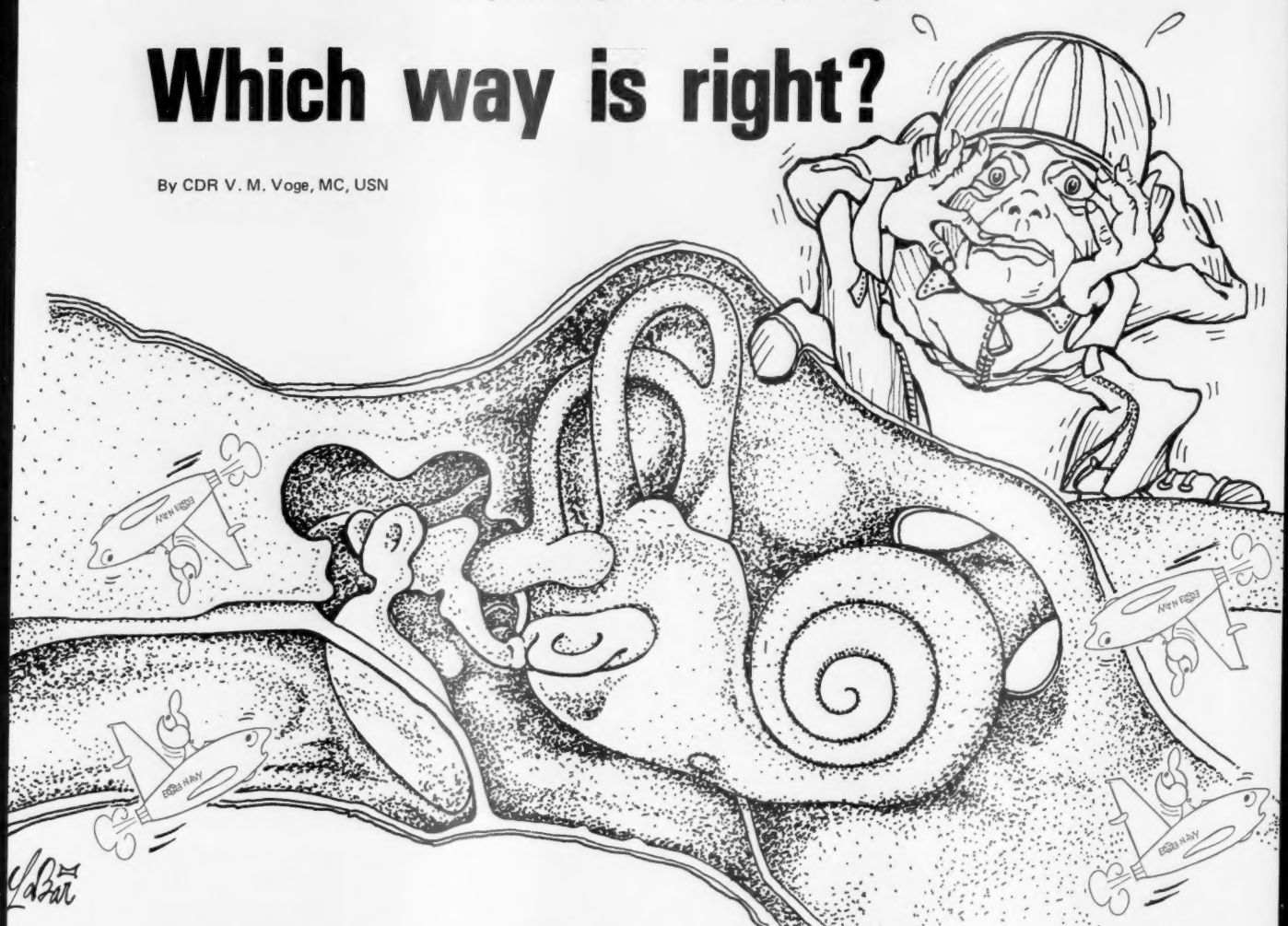
ABHAN Fox's courageous and prompt actions, in the face of great personal risk, prevented a fellow shipmate from sustaining major injuries and undoubtedly saved his life. Well done!

This is the second in a series of monthly APPROACH articles discussing the various forms of vertigo and spatial disorientation. If you didn't read last month's article, try to read it before reading this one, as many basic points were discussed. If you can't get to it just now – read on – but be sure you eventually get the ground rules as set forth last month. It will be easier, more enlightening, and more beneficial for all concerned.

Last month we promised to discuss the leans, the graveyard spin, and the graveyard spiral in this article, so here goes.

Which way is right?

By CDR V. M. Voge, MC, USN



THE *leans* have been the most frequently reported form of vertigo, both in the military and in the civilian aviation communities. It is an error in your perception of your roll attitude. There are several scenarios that can produce this illusion, but the results are the same.

Scenario No. 1: You're flying straight and level, but you let your wing drop ever so slightly and imperceptibly (at a rate of 0.2° to 5°/sec or less). You glance at the instruments, notice the deviation, and make a rapid correction. When you made your subthreshold roll (subthreshold for your semicircular canals, anyway), the liquid in the canals did not receive any noticeable acceleration cues and therefore did not register any change in attitude. Your correction, however, was far above the threshold, setting the liquid in motion and causing them to sense a change in attitude. As far as the canals are concerned, you went from straight and level flight to a roll in the opposite direction. The aircraft now is in straight and level flight, but you (or your semicircular canals) are in a bank. Thus the term *leans,* as you, the aviator, feel a compelling urgency

to make things right, i.e., to correct your perceived imbalance in that you feel you are leaning in the opposite direction of your original bank.

It has been found that if you get on your instruments and fly the aircraft in a straight and level attitude, you will tend to orient your body to the perceived vertical, or *lean* in the same direction as the original bank. Once your head and upper body are leaning in the direction of the original bank, there is the tendency to pull the stick to the perceived vertical, thus returning to the original banked attitude. This confusing sensation usually passes in a few minutes if one maintains instrument flight, but it has been known to last as long as 30 to 60 minutes! This causes one to experience a heightened stress situation, and can become quite fatiguing even to the most experienced of us if it is prolonged for any period of time. The incorrect response, of course, would be to roll the aircraft until you feel vertical (fly by the "seat of your pants"). This would put you back in the original bank attitude.

Scenario No. 2: The next scenario is the corollary of Scenario No. 1. Your aircraft goes into a roll rapid enough to register in the inner ear, but you return to wings level ever so slowly. This happens in bumpy conditions, such as clear air turbulence, storm areas, gusty wind conditions, etc., or you may do it consciously. The problem arises when you return to straight and level flight so slowly and smoothly that you fail to stimulate the inner ear. The semicircular canals think you are still in your bank attitude, as they have not been told anything to the contrary.

Scenario No. 3: Although we hate to admit it, many of us are not perfect, i.e., each member of our set of semicircular canals is not identical to the other (left and right). Many of our canals are more sensitive to changes in attitude on one side than on the other. This becomes noticeable especially in turbulent and bumpy conditions, where the aircraft continually makes small oscillatory roll movements. The more sensitive side perceives these movements more readily and gives the impression of movement in that direction, even when the aircraft maintains a basically straight and level attitude.

Scenario No. 4: An ear infection, barotrauma, or any medical problem affecting one ear more than the other can either sensitize or desensitize a "canal" system to the point where we may feel we are in a bank, without moving (have you ever seen someone walking lopsided?).

Scenario No. 5: This is a "catchall" group, with *leans* caused by the misinterpretation of visual cues, putting it more in the realm of disorientation than of vertigo. Here we have such things as using an erroneous visual reference, e.g., *cloud leans* where one orientates oneself using the bottom of clouds as a horizontal reference, or "lean on the sun illusion" where, while flying through clouds, we consider that "up" is where the brightest part of the clouds are.

Scenario No. 6: Cockpit design can also induce the *leans*. This is seen in those cockpits where the pilot is placed well forward of everything and can see the wings or other parts of the aircraft canopy only with difficulty; or where the instruments on the instrument panel are not aligned with the transverse axis of the aircraft, or the canopy has a sloping edge.

Scenario No. 7: You maintain a coordinated turn for more than 20-30 seconds and the semicircular canals "forget" that you are in a bank. When you correct the situation rapidly, the canals are stimulated, and things proceed as in Scenario No. 1.

Both the *graveyard spin* and the *graveyard spiral* are also semicircular canal problems, i.e., forms of vertigo.

If you were to fly into weather or cloud conditions and accidentally enter into a spin, and if you were to allow the spin to continue long enough (20-30 seconds), the semicircular canals will again equilibrate, i.e., "forget" to inform you of your rotational problems as they have now become the norm. Your feedback from your receptors tells you that you are not spinning. This can happen in any spin that lasts more than 20-30 seconds. When corrective inputs are executed and you pull yourself out of the spin, the semicircular canals perceive a new impulse in the opposite direction from the original. Result? You feel as if you're spinning with equal magnitude in the opposite direction while, in reality, you are straight and level. Why is it called *graveyard?* Because, if you do not trust your instruments, but believe in your "infallible" brain, you will respond by again spinning in the original direction. Result? You have just bought a piece of prime farmland!

The *graveyard spiral* is very similar to the *graveyard spin*, only this time it is caused by a prolonged, coordinated, banked turn. The novice aviator (certainly we "old pros" would never do this trick) would notice a decrease in altitude (caused, of course, by the loss of lift from the banking of the aircraft) and pull back on the stick to regain altitude. This tightens the spiral, especially so if power is added at the same time. Once in this situation for a period of time, the semicircular canals again equilibrate (think they are in straight and level flight). When proper corrections are implemented and the "canals" are stimulated, our novice feels as if he were turning in the opposite direction. If he doesn't get on the instruments, he will again return to his former attitude until he becomes the proud owner of a nice piece of that farm.

As you can see, if someone were to tell you it's "all in your head" when you complain of vertigo, that person knows what he's talking about!

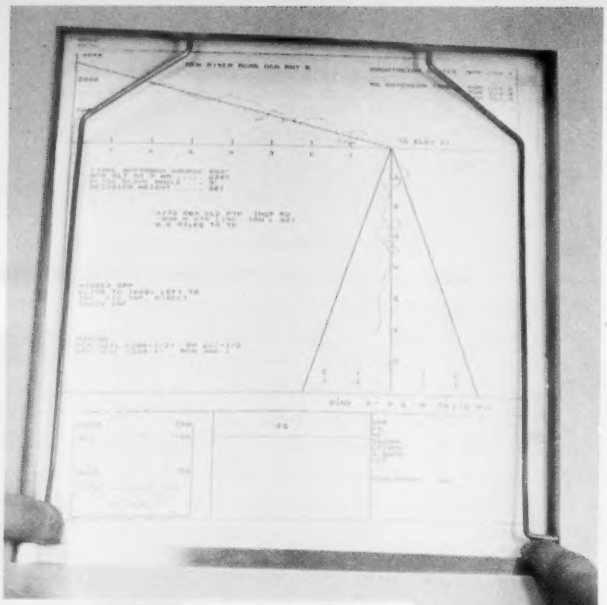
What can you do if you find yourself in any of the above situations to save your "winning smile"? First, admit that you're disoriented. Then, get on your instruments, and **believe** your instruments. Make those instruments read right.

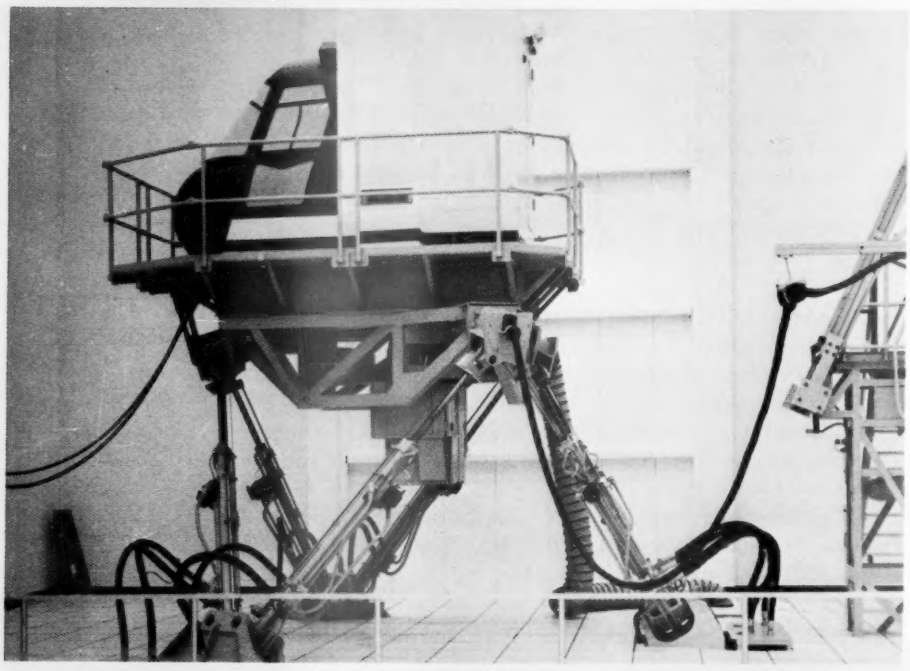
In next month's article, we'll discuss the somatogravic illusion. Don't miss it! ◄

NEW HELO FLIGHT TRAINER

By SSgt Cal Openshaw
MCAS(H) New River

Digital computers control the trainer system and are capable of producing automatic hard copy printouts of trainee performance.





Pilot trainees get the opportunity to practice inflight emergencies "without leaving the ground." The newest training aid for CH-46 pilots allows them to complete at least half the required instrument flight time without using a drop of JP5.

OCCASIONALLY, helicopter pilots face real, inflight emergencies that cannot be practiced in the aircraft. Some emergencies with which pilots need to be familiar, but wouldn't dare attempt to simulate in flight, are engine fires, or hydraulic and electrical failures. At best, solutions for these emergencies can only be assimilated from the printed page, or by word of mouth from other pilots.

After years of designing, building, and testing, an added measure of insurance that will give CH-46 pilots the crucial, needed practice has been unveiled at MCAS(H) New River. An OFT (operational flight trainer), device 2F117, has been installed. It's a multimillion-dollar flight simulator, designed by Reflectone, Inc., to give CH-46 pilots the opportunity to practice inflight emergencies, and to complete at least half of their required instrument flight time without leaving the ground.

The OFT is going to help pilots experience and control some of the emergencies they cannot attempt while airborne. The trainer is enclosed in a structure three stories high. It is a fully-computerized, life-size mockup of an electromechanically controlled CH-46 cockpit, mounted on a safety-railed platform and supported by three hydraulic legs that control the motion system. It looks like a vehicle from outer space from a sci-fi movie.

The trainer provides the means to: develop pilot-copilot proficiency; coordinate the operation of controls and instruments; interpret instrument indications; operate navigation and communication systems; and cope with a variety of emergency situations in takeoff, hover, flight, and landing by instructor-induced malfunctions.

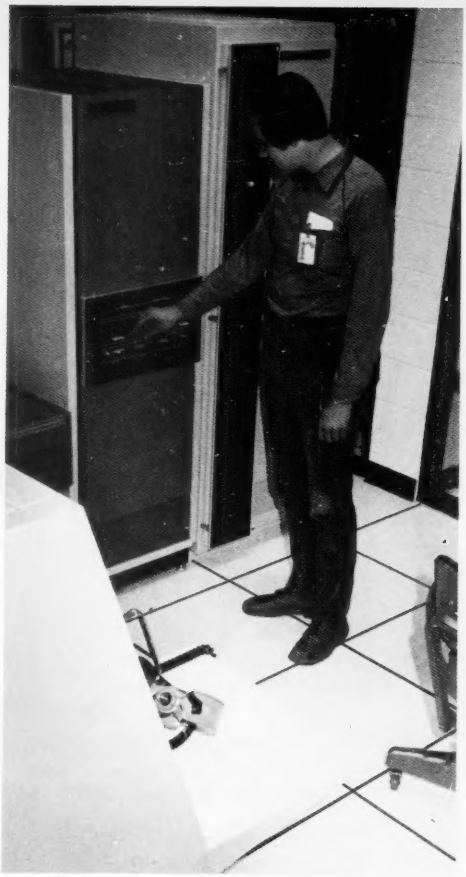
The trainer will respond to the controls just like a real CH-46. In addition to computerized programming for routine flight, there are also 189 emergencies and various weather conditions, including hail, which can be introduced. The spider legs can also duplicate the real helo's movements (including a 45-degree tilt) and, although the legs can only extend so far, the feeling of ascent and descent is genuine.

Behind the trainer is the computer room, the nerve center of the complex. Inside the glass-encased room, real-time digital computers control the trainer and are capable of producing hard copy and instructor-selected hard copy printouts of trainee performance. The room also contains a full complement of diagnostic and support programs, such as trainee performance evaluation, display compiler, and built-in test capability.

Inside the cockpit, behind the pilot and copilot seats, is another computer terminal used by the instructor for complete monitoring of trainee performance. The instructor's station controls are capable of providing: instant playback of all cockpit controls and indicators, including motion response; trainee exercises and checkrides, including automatic scoring of a pilot's performance; control of flight parameters and environmental conditions before or during simulated flights; and control for positioning the helicopter at locations within the problem world.

Realism is the word for the trainer. Pilots can even program the computer for an initial set of conditions, fly the route, and then play back the most recent 5 minutes to see how they did. While the trainer is programmed to indicate when the pilot makes a crucial error, the system is also programmed to crash. When such a situation occurs, the trainer freezes in position, a light flashes, and the instructor and pilot review what went wrong and how to avoid it the next time.

Although the trainer is in operation, the system is not totally complete. A visual program to complement the trainer is already in the works. The visual portion is scheduled to be incorporated in December 1980. It will include an area of 300 miles surrounding Eastern North Carolina, with flight routes to cities like Raleigh and Charlotte.

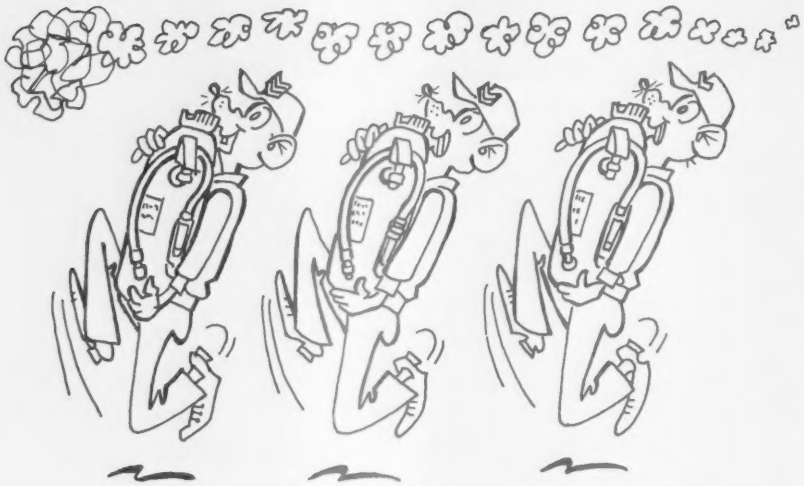


A field representative goes over the programs fed into the Corps' newest helicopter trainer.

Other services have similar trainers with visuals, but the Marine Corps trainer will be the only one to incorporate carrier landings and confined-area landings. The visual system will also be capable of posing problems to trainees for sling loading, formation flying, and VERTREP operations.

The 2F117 device is designed primarily for CH-46 pilots, but plans are underway to use the other half of the building for a CH-53 device. Present plans call for the delivery of two more 2F117 trainers; one to MCAS(H) Tustin in September 1980, and one to NAS North Island in February 1981.

Anymouse



Not Too Hot to Handle

A *Sea King* pilot completed a 14 2½-hour flight from the ship and landed at our base. He hot refueled and taxied to the transient ramp to shut down. He secured the No. 2 engine and applied the rotor brake. However, no pressure was available and the pilot let the blades coast down.

During the blade fold sequence, the pilot received a cut signal from a lineman on the port side as the blade fold switch was energized. He secured the No. 1 engine and saw the lineman giving the fire signal. He motored the engine to extinguish the internal fire as the No. 1 firewarning light came on.

The pilot pulled the T-handle and actuated the engine fire extinguisher, but the fire was put out by linemen with portable PKP fire bottles. The flightcrew left the helo via the cargo door. No one was injured.

The initial cut signal was given by the lineman when he noticed hydraulic fluid streaming down the port side at the lower front corner of the transmission platform. The fire ignited and engulfed the transmission and rotor head area, scorching fairing and burning several clamps, electrical lines, and boots. The fire burned on both sides of the No. 1 engine after firewall and around the handhold under the exhaust.

A rupture in the 3000 psi hydraulic pressure line of the blade fold unit occurred. It was due to chafing. The heat of the exhaust ignited atomized spray even though the engine was shut down. We found the chafed line to be in an area not accessible during daily or preflight inspection. However, it should have been detected before failure. Additional emphasis is being given this line during phase inspections.

A couple of side notes are worth mentioning. One is that the PKP was extremely difficult to clean up and we had to use complicated corrosion prevention measures to ensure minimizing PKP effects. We changed the No. 1 engine and rotor head as a precautionary measure. This aircraft had the new hydraulic fluid, 83282, and it will burn under certain conditions. All users should treat it with respect. One witness grabbed an extinguisher, climbed up the side of the helicopter to extinguish the blaze, and was personally responsible for contributing to the quick dousing of the fire.

Notsoyoungmouse

Crunches

I'M a GOB (good ole boy) with fire in my eyes, a roaring voice, and a ham fist itching to clobber careless, incompetent aircraft handlers. I've had a one-man campaign going on every ship I've been on, and in every squadron I've been in for close to 20 years. Just when I thought we had it made, I'm a SOB (sorry ole boy) if I wasn't rooked twice in a week.

The first mishap was minor if you're thinking in terms of direct man-hours and cost of repairs. However, if you're thinking like I do they don't really count. What counts is how and why a crunch occurs. That's what gets me riled.

A couple of weeks ago, during a lull in operations, I got all the directors and GSE operators together to review the squadron TIMI on towing aircraft. We had lots of questions and answers

The purpose of Anymouse (anonymous) Reports is to help prevent or overcome dangerous situations. They are submitted by Naval and Marine Corps aviation personnel who have had hazardous or unsafe aviation experiences. These reports need not be signed. Self-mailing forms for writing Anymouse Reports are available in readyrooms and line shacks. All reports are considered for appropriate action.

REPORT AN INCIDENT
PREVENT AN ACCIDENT

after covering the whys, and I thought everyone understood completely.

The next night we had a crew moving an A-4 from the line into the hangar for maintenance. A supervisor was given the job by maintenance control and put a crew together to do the job. While the aircraft was being dearmed, the supervisor went to maintenance control for information. Before he returned, the other four guys hooked up and started towing. The number in the crew was in violation of the TIMI (it called for six). The driver entered the hangar, which was full of other aircraft, and couldn't keep the wingwalkers in sight. Although the brake rider saw the wing clearance wasn't enough, and hollered at the driver, a collision with another aircraft occurred.

This was a blatant disregard of squadron directives. No one had a whistle, and the tractor driver was proceeding without a director. This took place on a Friday night and all the studs had their minds (?) on something other than towing. They wanted to get the job done and secure early.

If that wasn't bad enough, 6 days later there was another mishap. This time there were the right numbers in the tow crew, they had whistles, the brake rider knew he had brakes available, but the dummy on the tractor couldn't follow directions. He was being directed straight ahead but elected on his own to turn. He did and ruined the empennage when it collided with a parked object.

If there's such a thing as a good thing when an aircraft is damaged, I got the driver. He had been a hot-dog previously and had been warned. This time he lost his license and had other things to think about.

Just like I tell everyone here, supervisors have to be tough, keep on top of their men *all the time*, personally check to make sure they have the right equipment, keep them from horsing around, and ensure they don't try any shortcuts.

Lividmouse

Hurry Up

TWO pilots were scheduled for an early morning flight in their *Huey*. They reached the flight line before anyone else and conducted a thorough preflight. Satisfied that everything was normal, they entered the cockpit and strapped in. The plane captain showed up moments later and started to remove the tiedowns. However, the pilot in command asked the plane captain to discontinue removal of tiedowns and man the fire bottle for start.

The plane captain took up his station, and, after a normal start, proceeded to remove the remaining tiedowns. He checked the engine/transmission area for leaks and ducked under the rotor arc to replace the fire bottle in its regular place. As he turned back toward the helicopter, the pilot was impatiently signaling he was ready for takeoff.

The plane captain looked behind him to clear the area and gave the pilot an OK to go. The *Huey* became light on the skids, and the plane captain saw one rope tiedown still attached. His reaction was to give the signal to land, but it was too late. The pilot felt the helicopter momentarily resist his efforts to get airborne, so he gave a positive, extra dose of collective and the helo became airborne.

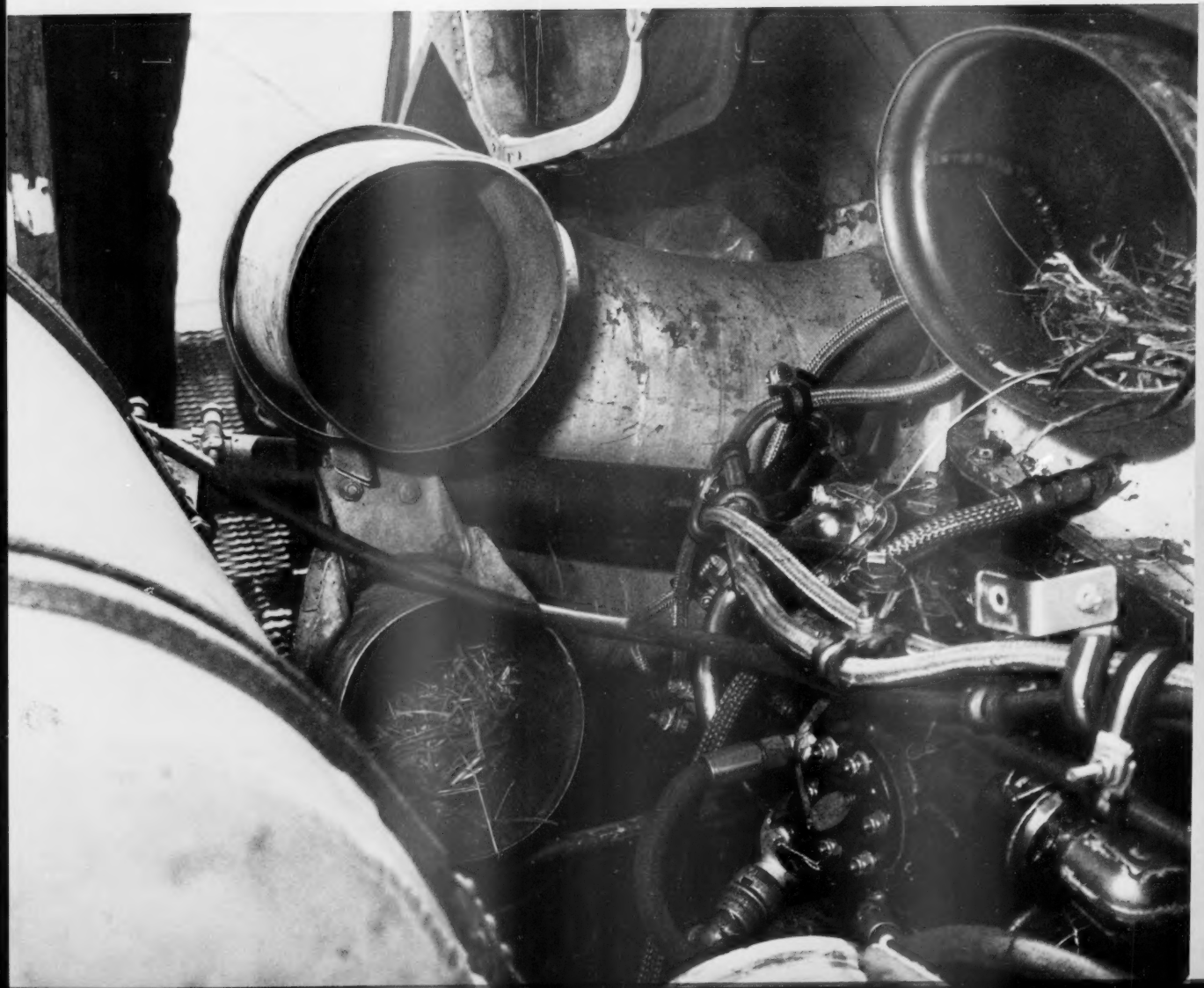
The pilot saw the signal to land and complied. The piece of rope still attached to the helicopter was removed, and an inspection revealed no damage.

Under other circumstances the pilot could easily have been the 89th sucker to attempt a takeoff, with tiedowns attached, and crash in place. He tried hard to earn a delta sierra. What was his all-fire hurry?

- He didn't verify that all tiedowns had been removed.
- He rushed the plane captain into not verifying the aircraft was ready to launch.
- He broke the plane captain's habit pattern when he directed him to man the fire bottle instead of waiting for all tiedowns to be removed.

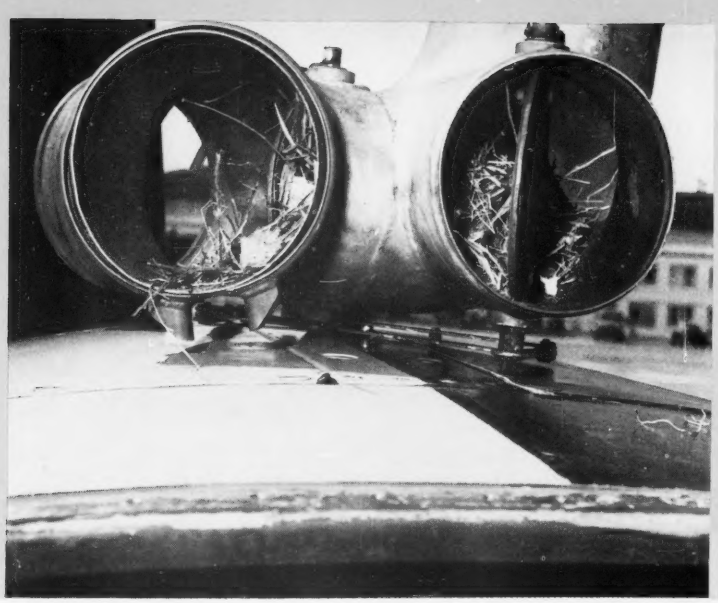
Iratemouse

Birds do more than



SING!

By LT R. E. Edmonson
NAS Whidbey Island

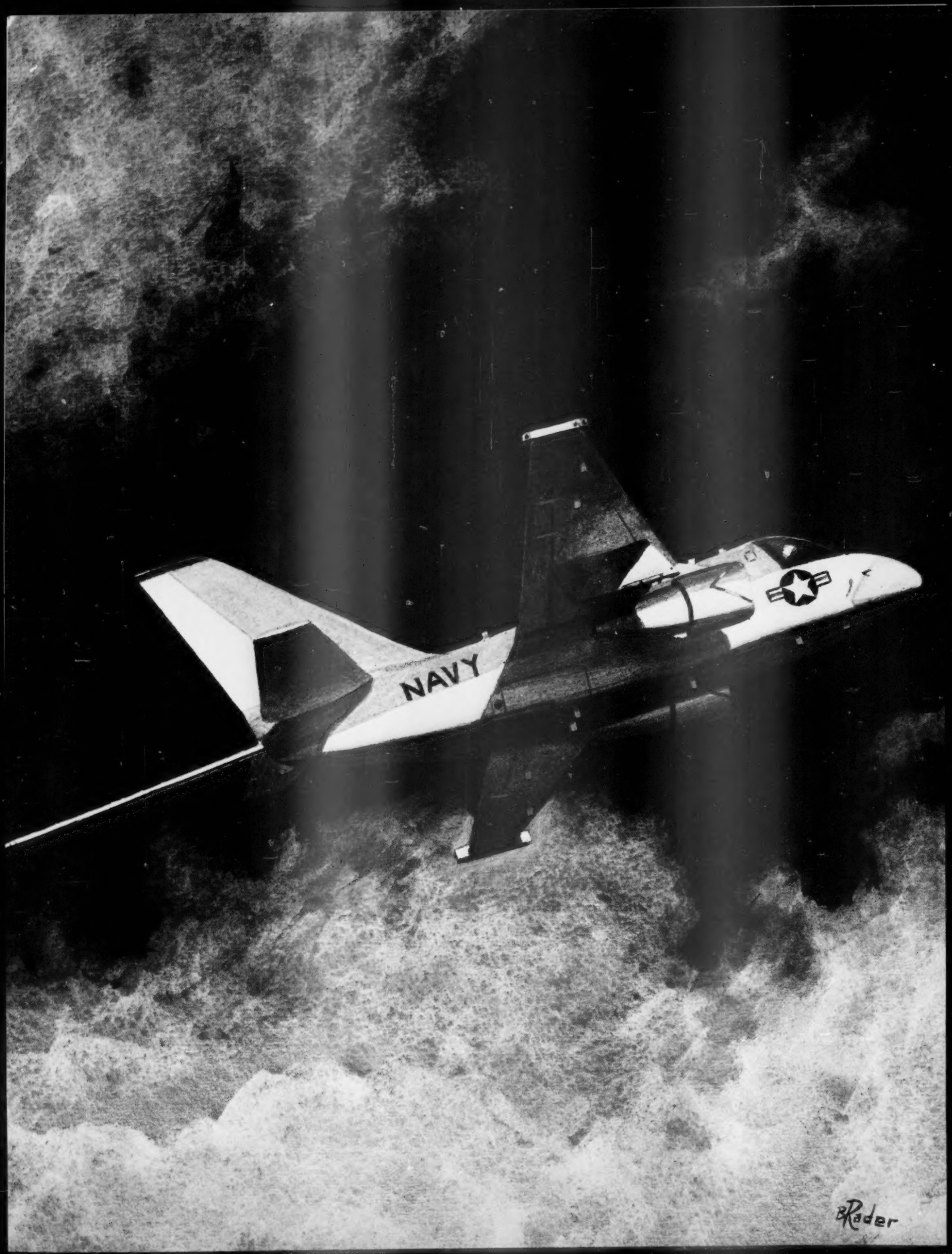


IT was a beautiful spring day. The sun was shining, lots of blue sky showing, and birds singing. A perfect day for flying! The C-1 crew conducted a normal brief and preflight for a local training hop. Taxi and takeoff checks were all normal, and the crew anticipated an enjoyable hop around the local area. Takeoff clearance received, the C-1 was positioned on the runway and the final power checks were performed. Everything was go; now to make like a bird!

The pilot applied power smoothly; the C-1 accelerated on its takeoff roll. But, at full power and 2500 rpm, the No. 1 engine was producing only 40 inches MAP. Takeoff was aborted with no problems. After the abort, the engine was run to full power, producing 39 inches MAP at 2500 rpm. With all other indications normal, the maintenance crew had an interesting problem to solve. After removing the cowling for a closer look, they discovered a bird's nest on the carburetor intake screen. "Fowled" by fellow flyers!

Subsequent investigation of the No. 2 engine, and both engines on the station S-2, also revealed the handiwork of the busy birds. They had constructed these nests in less than 18 hours, in a location not readily visible on a normal preflight. To avoid future occurrences, styrene foam plugs were constructed to prevent access to the carburetor.

The next time the sun is shining with lots of blue sky showing and birds singing, you may not be the only one with spring fever! ◄


NAVY
B Rader

Profile of a Mishap

Anonymously Submitted

IN an era of austere funding and costly machines, the Navy budget can ill-afford to suffer inventory losses as a result of aircraft mishaps. Whenever human error, especially pilot error, is attributed as the direct cause of an aircraft mishap, high-ranking naval officials automatically embark upon an extensive search to reveal pitfalls in ongoing safety programs. Sometimes, indepth analysis can uncover rectifiable program weaknesses, but this is not always the case. Consider, for example, the involvement of an experienced second tour aviator in a mishap where the often used but most distressing verbiage of "complacency and failure to adhere to established NATOPS procedures" is assigned as the direct cause. In the opinion of this writer, the mishap investigation must delve beyond this level to expose the proximate causes which might have indirectly contributed to the mishap. Obviously, the intent is to prevent similar occurrences in the future through a study of human behavior. This is certainly not new, but is often overlooked. In an attempt to stimulate further discussion, this article will hopefully act as a catalytic agent with the review of a profile of a typical second tour aviator and the presentation of personal opinions on the subject.

Enter the second tour aviator, with 11-14 years of tenure in the Naval service, in receipt of orders to report to a command undergoing type training. Perhaps he has just completed a tour in a nonflying or proficiency assignment that spanned 1-3 years, and upon completion of the prescribed length of RAG training (based upon currency of experience), he is ready to report to his ultimate duty station.

Prior to reporting aboard, this officer is concerned with providing his family with an adequate domicile. Consequently, he is beset with the usual pressures associated with financing a home and preparing the household for his departure on workups/deployment. Of course, these problems are usually easy to resolve except when the nation is experiencing severe economic woes. Confronted with adverse economic conditions, the threat of an unstable household during an upcoming deployment can certainly affect an officer's performance. This problem assumes a level of greater significance when the mortgage company misleads the applicant by building false hopes of impending approval only to be followed by disapproval of the mortgage application after an inordinate delay in processing.

Following an abbreviated leave/travel period, the second tour aviator reports aboard his new command. In some cases, the officer whom he is to relieve has already detached. Combine that with a rapidly approaching deployment date and a mediocre assumption of duty can result.

Although this officer possesses substantial experience both in the air and on the ground, he must "reset himself to square one" as he attempts to fit into his new organization. There are new relationships to be formed, and dependent upon the political underpinnings involved, he must condition his behavior to meet new challenges. Such relationships can be problematic, especially where his predecessor and other key players operated on "rocky" ground, with less than successful results. In this case, the load can be even more burdensome as the specter of "ill will" overshadows the formation of new alliances. The casual observer might view this as normal, but indeed, when combined with other problems to be discussed in future paragraphs, normalcy can lose its place.

Suppose this officer is in the zone for command screening, which has been his foremost goal. In his new position, he is mindful of the need to literally attack his duties with great zeal in order to remain abreast of his competition. Although he possesses a fine record, he is deeply concerned, in fact worried, about his being selected. Why should he worry? There is no apparent reason to do so; only that he is now in a position where he must reestablish himself in the pecking order. Of course, famous last words are most appropriate since "worrying, no matter how intense, has never changed the course of history." But one cannot discount the fact that the results of the Aviation Command Selection Board occupy a part of his thought processes.

With these perceived pressures clouding his judgment, he is scheduled to fly his first hop at night after a 30-day layoff. Under normal circumstances, he would probably have asked not to be scheduled in this manner until at least having had daytime, back-in-the-saddle training. Instead, he rationalizes his situation by virtue of his experience level in the aircraft. Additionally, he senses a pressure to fly (whether fact or fiction), again referring to the impressions established by his predecessor. His immediate objectives are to display his aggressive nature and to instill a sense of concern for full integration into the command routine.

The night of his fateful flight arrives, and with some trepidation, this officer prepares for the flight. As a result of a late schedule change, he is designated as the pilot in command and proceeds to plan the flight according to NATOPS and in conjunction with his assigned mission. It has been a long day, and he is beginning to feel fatigued from intense concentration on his new assignment, coupled

with the strain of "new house woes." A dedicated and highly motivated officer, his can-do spirit and desire to fly outweigh sound judgment in determining the **need** to fly.

Upon filing his flight plan, he discovers that the weather is due to deteriorate prior to his recovery time. Accordingly, he selects a suitable alternate and informs the duty officer that the flight will be terminated earlier than scheduled. A good instrument pilot, he has flown many approaches under adverse weather conditions and feels capable of confronting any meteorological challenges.

He reviews the aircraft discrepancy log and proceeds to his aircraft, which has been preflighted by the crew. The start and pretaxi procedures are accomplished expertly and without flaw, but taxiing is delayed by a maintenance discrepancy. From this point on, the pilot's memory banks are tested on the pressures which he has attempted to leave behind. Crew discussions focus upon subjects particularly distasteful to him; the results of the screening board, his economic woes, and the new job provide the principal subject matter. Anyway, the aircraft launches for the assigned mission. Despite the late departure, the ASW portion of the flight is most successful.

During the long transit home, the pilot maximizes the utilization of the autopilot in preparation for the final approach, but continues to make mental notes of his personal dilemma. As the flightcrew prepares for the approach, the copilot reviews missed approach minima and procedures as well as the backup he will give the pilot. Preoccupied with flying in instrument conditions and fatigued from the long day, the pilot at the controls *understands* the copilot's instrument monitoring procedures to be in consonance with normal backup procedures.

During the approach, the pilot's mind begins to wander; his span of attention is not dedicated to his instrument scan. He scans the gages, but fails to respond to aircraft deviations or to the controller's calls. Indeed, he is not fully concentrating upon the flightpath or disposition of the aircraft, but appears to be preoccupied with external matters. The results are ingrained in history as damage is inflicted through an unintended yet inexcusable violation of NATOPS.

The perceptive reader asks, "Why would anyone choose to fly when in a fatigued state and with so much on his mind?" The armchair quarterback quickly suggests that this aviator should have passed on this flight. But the individual **perceived** the need to fly; he wanted to achieve rapid integration into the routine of his new unit and prove his aeronautical ability. Close scrutiny of this pilot's dilemma reveals that he had all the "checks in the blocks" necessary for a mishap. The can-do spirit has bitten the proverbial buttocks once again, and the results were disastrous. Fortunately, the aircraft only received minor damage and

the crew was unharmed. But the pilots came under the gun. Why did the pilot violate NATOPS? Why did the copilot permit him to do so? Somehow the notion of *complacency* or *business as usual* does not provide the total answer. The important issue is not how to punish the participants, but rather, how COs, XOs, safety officers, and operations officers can deal with such problems.

There are no quick and easy fixes for such problems, but there are some rules of thumb which can be employed. From the top, a command must scrutinize the situation before scheduling an individual as a pilot in command (if feasible), especially if he has not had hands-on flight time for a period longer than 10-14 days. Provide him with adequate back-in-the-saddle training. Ensure currency in NATOPS procedures, local course rules, and the command SOP. Make certain that he is well aware of his need to fly, but not by intimidating him with undue pressure.

COs and XOs must be especially cognizant of the pressure which can be brought to bear upon a new arrival by filling his head with the **don'ts** of the job. Take a positive approach by informing him of command expectations and the importance of his billet in the

accomplishment of the overall squadron mission. Find out what his goals are, and share thoughts about the command screening board (if applicable). Stress the importance of maintaining his aeronautical skills, but not by pressuring him to fly regardless of mental or physical state.

So often the individual senses the way to avoid the bad deals (such as standing the duty) is to go flying despite the presence of fatigue, illness, or pressing personal problems. Similarly, crew duty time must be adequately addressed; often the seasoned aviator pushes paper for 10-12 hours and then courageously dons his flight gear for a 6-7-hour flight evolution. Despite one's perception of his own capabilities, attempting to hook the No. 3 wire at 0200, under instrument conditions, at the tail end of a 16-17-hour day could prove disastrous. Sound familiar?

An excellent example of this type of individual is a member of a CVW or CARGRU Staff – an office with a never-empty "in" basket. This officer can easily remain at his desk for 18-20 hours a day and be barely on top of the administrative or operational brushfires. But, fly he must in order to maintain currency and proficiency. When he leaves his desk to go fly, he must also leave his personal problems, pressures of his office, and the overflowing "in" basket behind. He must be physically rested and mentally prepared to effectively carry out his assigned mission. Proficiency must not be sacrificed for pushing paper work. At the same time, this individual must remain on top of NATOPS (aircraft, CV, instrument, etc.). The pressures of his office must not provide the convenient scapegoat for not being thoroughly knowledgeable of NATOPS procedures. As the experienced aviator, he must be the vanguard of the NATOPS program.

Indeed, this staff member exhibits a high potential for involvement in a mishap regardless of time on the job (whether 2 months or 2 years). He must, therefore, be more conservative and cautious in preparing to fly. Here, the often used adage, "leaving problems in the in basket; and

not to worry, the problems will still be there after the flight returns," is most appropriate.

To sustain a professionally-oriented safety program is no easy task. The keys to such a program rest with superiors exhibiting wisdom, understanding, and concern for the problems of subordinates.

This article has focused upon the second tour aviator, but there were no rules established to exclude similar pressures from falling upon the first tour aviator. Regardless of background, experience level, or position of authority, each officer must take a hard look within himself to ascertain his ability to deal with mental and physical problems. He must recognize his limitations and attempt to resolve problems within his domain of power. If he is not ready to fly, he must exhibit the courage to **not fly** and take care of business, or to fly and leave the problems until after he returns. However, the second tour aviator must set the example for his juniors.

This article does not contain the precepts of any magic formula as a means of sustaining a practical safety program. It simply stresses the basics of sound leadership. Safety is little more than the employment of basic leadership skills in the execution of applicable directives and regulations related to training, readiness, retention, etc. Seldom does a profound safety program involve "hunting down the culprit" and levying punishment as if he were a criminal. It implies the necessity for reviewing current policies and procedures, and utilizing the experience of a mishap as a tool for improvement, not for destruction. Do not construe this statement to imply the adoption of a "cavalier attitude" toward aircrew involvement in mishaps, but rather the impetus for wisdom, understanding, and courage in reviewing the proximate causes for a mishap.

Does anyone in the audience fit the mold? Who has the courage to say no to a flight or to hell with the problems? Think about it!

Among other things, the purpose in flight planning is to ensure you have enough fuel to do what must be done and still have enough, considering contingencies, to land at your destination – with reserves. The whole idea is to . . .

Prevent the

CH-46 helicopters are short-legged aircraft, and pilots who fly them are called upon to figure their fuel required very closely. Even good pilots can be fooled some of the time. Here are a couple of tales which should be of interest to all pilots – regardless of the type of aircraft you fly.

One HAC and his crew took off from USS BOAT on a MedEvac flight. The pilot flew a short leg to the beach, and stopped at an airport to brief and file an overland flight plan. His destination was VFR with visibility forever, only fluffy, scattered clouds at 3000; winds on the surface were 13 knots. His local weather was similar. There was, however, a hooker. There were no en route navaids and no winds aloft were available.

The crew departed on a VFR plan and climbed to altitude to cross a mountain range. Instead of scattered clouds, they had to climb up through a broken layer at 5000 feet in order to get on top. The MEA was 7000 feet anyway, so they climbed to 7500. Initially their groundspeed was 110 knots, as planned. They had no stations or DME ahead of them on their route, but at altitude they did get a couple of questionable cross-checks. They had based their ETE on 110 knots groundspeed and figured 1 + 30.

After having been airborne a little over an hour, a prominent checkpoint showed them to be slower than anticipated and still 45 miles from their base. The "pucker factor" rose and the pilots began discussing contingency plans. They knew they'd never make it. Fuel was critical, they couldn't reverse course, and there was nothing below them but rugged terrain.

The crew continued boring ahead until their fuel indicated 400 pounds. By that time they had reached better terrain conditions. They called their destination and advised that they were going to make a precautionary landing. Fortunately, where they landed they were able to obtain fuel from local sources. The fuel was carefully inspected for contaminants and was filtered twice during the transfer into the helicopter. Low point samples were checked without anything unusual. The HAC then took off and completed the flight to destination – 10 minutes away.

The unexpected almost caused a "gotcha." Two conditions caused them to land short of their destination. Their groundspeed overall turned out to be 90 vice 110 knots, and their fuel consumption was 1350 pounds vice the 1200 pounds planned for.

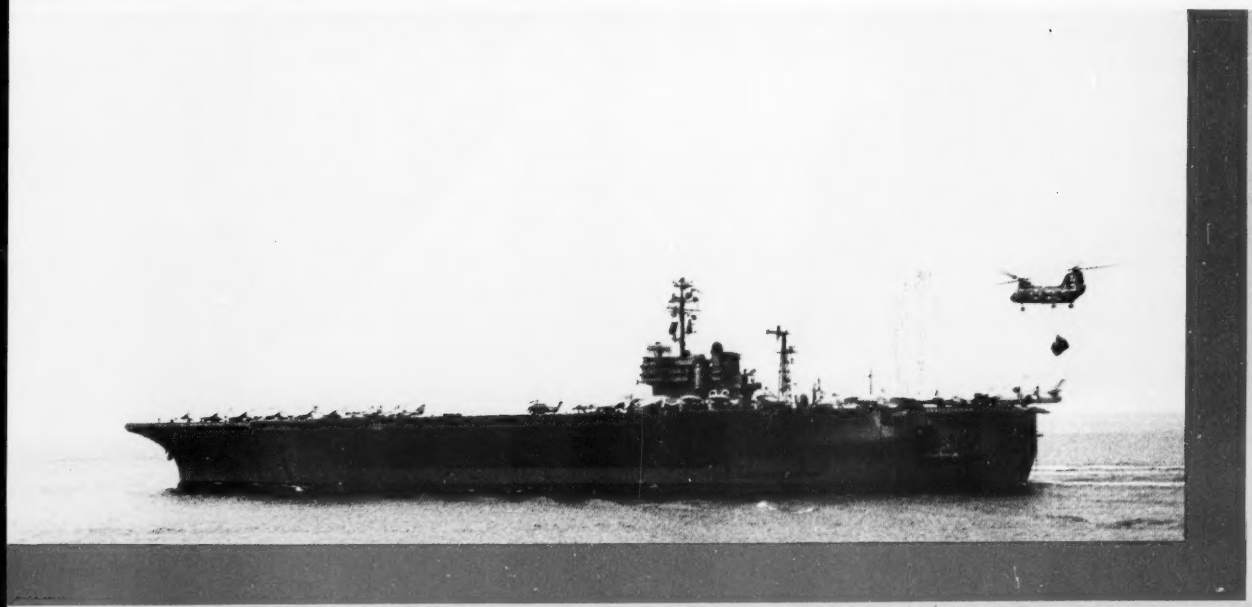
The HAC followed NATOPS when his fuel read 400 pounds and made a precautionary landing. Had he tried to stretch it, he most assuredly would have had a "gotcha." His fuel gage was not accurate below 400 pounds. The HAC took a hit, however, for climbing above the broken layer on a VFR plan and for pressing on without adequate navaids.

Another HAC, in his CH-46D, was on a supply flight within the task force. He had some parts for a ship in the outer screen, about 75 miles away. His flight planning, figured conservatively, allowed the crew to proceed to the general area, make one search sweep, and return to their own ship with an 800-pound reserve.

They reached the screen, turned toward their search sweep leg, and achieved a TACAN lock-on at 24 miles. They flew to the ship, transferred the parts, and elected to take HIFR (Helicopter Inflight Refueling) as an additional cushion. However, after fooling around for some precious time, HIFR became impossible and the time lost made them fuel critical. They set a max range profile and headed for their home away from home.

When their fuel reached 500 pounds remaining and they had not made contact with any ships, the copilot switched the IFF to 7700 and broadcast a Mayday. A destroyer answered immediately, even though the ship was under EMCON, fired up its TACAN and radar, and picked up the helicopter. Shortly thereafter, a "big boy" turned toward the distressed helo, to close the distance. The helicopter pilot made it, barely! When he landed, his gage read 80 pounds in each stubwing tank (nothing but fumes). The ship refueled the CH-46 with 350 gallons. Max capacity is

preventable



380 gallons.

There's no doubt that the response of the ships to the Mayday was letter perfect and prevented the loss of the *Sea Knight.*

Just as the pilot in the first incident, this HAC forgot something in his flight planning. The mistake was not including on-station time in his flight planning. Everything else was considered, but his initial estimate of 800 pounds remaining was in error. Had he considered the extra fuel consumed on station, at hover power, he would have realized his fuel on return would be much less, rendering additional on-station time a poor choice.

Having committed himself to a HIFR, there was still a chance to get fuel, even if it meant landing on an uncertified deck. In the light of what happened, it may have been a prudent choice.

Time required to make search sweeps usually takes longer than planned, since ship positions generally are several hours out of date. Additional time should be allowed to conduct a search, and return to Homeplate from a more distant position. Also, pilots need to remember to allow for navigation errors, unforecast weather, and both course changes and screen shifts.

This incident should be the proverbial 2 by 4 to get the attention of all pilots. It also cries aloud for ships' COs to review HIFR requirements, hardware, and procedures so that HIFR ships can deliver when helicopters need fuel. What good in the world is a capability when it can't provide fuel in an emergency? Do it right the first time! Finally, a comment needs to be made to remind ships' COs to review logistic requirements and flight-following procedures – especially under EMCON. No one questions the value of operating under EMCON in peacetime but, like the destroyer/carrier/big boy did when the pilot was in *extremis*, light the lights, fire up the TACANs and radars, and help the pilot. ◄

THE FLIGHT ENGINEER

By LCDR N. Ryan
VP-30

THE P-3 *Orion* had just completed a 10-hour patrol and, as the aircraft passed over the runway numbers, everything appeared to be going well. The mainmounts straddled the runway centerline on touchdown, and as he gently lowered the nose to the pavement, the plane commander mentally congratulated himself on the landing. It wasn't a "greaser," but it was certainly smooth enough to avoid the groans, catcalls, and unsolicited first aid kits that are often provided by the remainder of the crew following a landing.

As he gently pulled the four power levers into reverse, his self-satisfaction was replaced by apprehension and, for a moment, misunderstanding. In a split second, during the reversal, the aircraft had swerved rapidly to the right, and in spite of his correction, it seemed inevitable that the

aircraft would leave the runway.

Suddenly the flight engineer's voice filled the flight station, "No Beta light No. 1; it's pitchlocked!" Instinctively, the aircraft commander called "Feather No. 1." The flight engineer, anticipating the call, wasted no time pulling the emergency shutdown handle, securing the malfunctioning powerplant. The aircraft commander's corrective actions now took effect, and a trip through the weeds was narrowly avoided.

The entire incident had taken about 5 seconds, during which time the aircraft, essentially out of control, had used nearly 1000 feet of the runway.

P-3 aircrews consist of highly qualified individuals who, with continuous training and much determination, work together to fly their missions in the safest manner possible. The flight engineer rating is one particularly germane to this task. Maintaining the readiness of P-3 powerplants and many other complex systems, correcting malfunctions during flight, and knowing all emergency procedures are but a few tasks the flight engineer performs routinely. The long hours a flight engineer trains at Patrol Squadron THIRTY, the Fleet Readiness Squadron on the Atlantic Coast, pay off for the Navy as a whole in the form of an outstanding P-3 safety record, and for the individual crewmembers whose welfare depends upon his proficiency.

VP-30 has trained approximately 120 flight engineers per year since 1963, using a tried and proven 19½-week training program. Prospective flight engineers start with the very basic systems of the P-3 aircraft, proceed through simulated and actual flying, and terminate studies at VP-30 after flying ASW training missions.

The first phase of training at NAMTD (Naval Air Maintenance Training Detachment) 1011 takes 5 weeks, and consists of lectures on the basic aircraft systems: electrical, airframes, air-conditioning and pressurization, powerplants, propeller, oil, hydraulic, armament, and foul weather. The prospective flight engineer needs to be fully familiar with not only the basic concepts of each system, but their shortcomings and possible malfunctions as well.

The next 5 weeks find the student still in the classroom, for 213 hours of ground training. Students learn about aircraft weight-and-balance, math, as well as the systems for foul weather, autopilot, fuel, and emergency procedures. During this stage, students also experience five sessions in the cockpit familiarization trainers and eight in the operational procedure trainers.

During familiarization training, the third phase, the student flight engineer receives an introduction to crew coordination – that all-important "thing" that allows the three flight station crewmembers to function as one safe, professional unit.

It is during this stage of training, possibly the most intensive, that the student flight engineer has the opportunity to put into action the lessons which he has learned during his hundreds of hours of ground school, trainer periods, preflight briefs, and postflight debriefs. During 24 hours of cockpit procedures training, 24 hours of flight simulator training, and 19 flight hours, the student flight engineer, working with two replacement pilots (under the guidance of an Instructor Pilot and an Instructor Flight Engineer), is exposed to nearly every conceivable malfunction and emergency possible in the P-3 – from the failure of a single instrument, to simulated engine-out landings. The student flight engineer is continually evaluated in his handling of all normal and emergency procedures during this phase of training, and his success or failure at VP-30 is often determined in this very demanding stage.

The final phase of training, during which the student flight engineer will have the opportunity to function as part of an entire ASW crew, is the ASW/Navigation phase. Here he has the opportunity to put together all of the previous 15 weeks of learning, and function as part of a crew which is training to use the aircraft for antisubmarine warfare. It is in this final phase that he begins to learn his responsibilities as an enlisted crew leader, and to put to use his knowledge of planning, for extended overwater operations. In addition to his new responsibilities, he is continually quizzed and checked, in flight and on the ground, to ensure his retention of the myriad aspects of normal and emergency procedures, temperatures, pressures, airspeeds, and weights that he learned in the three previous stages.

The purpose of all this training is not, surprisingly, to qualify individuals as flight engineers, but to train them for the flight engineer NEC rating. After completing VP-30's syllabus, graduates are assigned to operational VP squadrons where, in accordance with COMPATWINGS-LANTINST 1542.2C, they receive approximately 6 more months of training before fully qualifying as a Fleet flight engineer.

To qualify for flight engineer training, individuals must be E-5 or above, and serving in AD, AE, AMH, or AMS ratings. They must be highly motivated, career oriented, have 2 years obligated service remaining after completing VP-30, have a current flight physical, and a combined GCT/ARI of 105 or greater. Individuals with these qualifications have an 85 percent chance of successfully completing VP-30's flight engineer training program.

The course is demanding, but the profession of a P-3 flight engineer is both challenging and rewarding, and places the individual in a position of responsibility almost unparalleled by any other enlisted billet in the Navy.

BUT I CAN HACK IT!

By LCDR C. C. Alton
VP-17

HOW many times have you said to yourself, "I don't like violating NATOPS [or some other safe operating procedure], **but I can hack it**"? We all feel the pressure at one time or another to give a mission 150 percent effort – the extra 50 percent "borrowed" temporarily from our bank of safety "good sense." However, the first tour aircraft commander or mission commander often seems more susceptible to succumb to this pressure because of his intense drive to succeed and lack of experience which would help him make the right decision when faced with turning down/aborting a mission. To be successful, no squadron safety program can ignore the "hack it" syndrome and its "Pandora's Box" of hazards.

Our squadron's safety program has had a good reputation in building confident and professional first tour aviators. In an effort to analyze which facets of our safety program are defective in this area, an intensive study was conducted; the goal of which was to decide which factors of the program were effective in instilling our first tour aviators with the competence and confidence of older, more experienced aviators.

While many factors are relevant, the following three were picked as having the greatest impact:

- **Definite Command Position** – an explicit and strongly verbalized command position regarding the mission continuance in less than optimum conditions. This is in addition to the standard "safety of flight is paramount," which often comes across as slightly flexible to the first tour aviator.
- **Positive Peer Pressure** – other squadron aviators supporting the "professional" mission accomplishment point of view. Clearly recognized as a major influence, especially on the first tour aviator, peer pressure is used on the safety side rather than the "he couldn't hack it" side of the standard squadron bull session.
- **Strong NATOPS Program** – an effective and educational standardization program which prepares the aviator to act professionally in any situation.

All three factors are essential, and as such, one cannot be pointed out as being more or less important than the others.

When a new PPC is designated, he hears the commanding officer's position directly from the front office: "You'll have my complete support in aborting a flight on a 'judgment call,' but if I ever learn that you continued a flight in an unsafe situation, I'll kick your . . ." When faced with a safety of flight decision, a new aircraft commander should not be trying to second-guess the *Monday Morning Quarterbacks* on the ground. Once a command position such as ours is made, however, there is the challenge of living up to it. Many times the CO will be tempted to censor or question an aircraft commander's decision, but he must consider his "charter message" and the impact it had on the man's decision.

Peer pressure is an intangible area, but one which can have an extremely important and beneficial impact on any safety program. Two things that are relevant in using peer pressure are:

- Creating a positive peer attitude towards safety (the most difficult part), and;
- Providing an atmosphere in which peer pressure can operate (i.e. – all pilot meetings, etc.).

Constant attention (education) is required to nurture the attitude that safety really is something more than just a word. Equally important in maintaining that special group support is the opportunity for the free exchange of ideas. All pilot meetings, the Anymouse program, safety sighting programs, Pro of the Week recognition, and realistic incident reporting all serve toward this end.

Last, but not least, is the NATOPS program. From the first day an aviator reports onboard, the standardization program is emphasized as a key element in his successful progression. Really, unless an aircraft commander or mission commander has a firm knowledge of NATOPS procedures, tempered with repeated actual training, how can he be expected to take appropriate action when an emergency arises? Quarterly NATOPS examinations on the squadron level, available PQS instructors published daily in the flight schedule, and qualified, highly motivated personnel in the NATOPS department are useful in maintaining a strong and educational NATOPS program. As stated previously, each of these three facets are interrelated, and thus a strong NATOPS program and command support are necessary first steps.

In conclusion, nothing can do more harm to a safety program than the "hack it" attitude. The reason – the *can-do-it-all-the-time* mentality defies reason, or logic. A safety program which has strong command backing and positive peer pressure **for** safety, as well as a NATOPS program grounded in fundamental aircraft knowledge and emergency procedures, has a superb headstart on the ever present "hack it" trap. ◄

Anticipation or Assumption?

Anonymously Submitted

AS an air traffic controller at a busy jet training command, I have seen and been involved in several situations that were dangerous and could have been avoided had the controller and/or pilots involved been just a little more alert. The example below happened to me and certainly reemphasizes the need to stay constantly alert and not **assume** that you know what someone's intentions are.

A flight of two A-4s were forced to return from their training hop early because of a low oil pressure indication in one of the aircraft. An emergency was declared, and Approach Control relayed to the tower the pilot's intentions to make a precautionary approach to a short field arrestment. I was working local control. Normally, we have two sets of 8000-foot parallel runways available, but due to construction, 21R and 25L were closed. Both sets of runways intersect at midfield. Since 25R was the duty runway, I decided to sequence the emergency aircraft onto 21L in order to keep the duty runway open.

Approach vectored the two aircraft into a point about 5 miles west of the airport, and I was then given control. When the flight was about 2 miles west on an extended base leg for 25R, I went ahead and cleared the flight leader to land on 25R. After all, the emergency aircraft had told Approach Control that he was going to do a precautionary approach, so he still had several miles to go. This would allow the flight leader plenty of time to complete his landing rollout, or at least clear the intersection of the two runways.

Normally, when an A-4 requests a precautionary approach, it is done as an extended straight-in approach. The aircraft is kept unusually high until it reaches a point between 3 and 4 miles from the runway and then a rapid descent to the runway is made. I cleared the emergency aircraft to land on 21L and diverted my attention for a moment to another aircraft in the pattern. When I again returned my attention to the two aircraft I had cleared to land, the flight leader was just beginning his landing rollout on 25R and, to my surprise, the emergency aircraft had not done what I **assumed** it would, but was touching down on 21L. This was frightening enough, but since the emergency aircraft was anticipating an arresting gear engagement, and since the runways intersected at the 4000-foot remaining marker, I would get away with my judgment error this time. Right? Guess whose hook skipped!

Now it was much too late to send either aircraft around, and a collision at the intersection appeared to be imminent. As the aircraft approached the intersection, I made a transmission to both aircraft to hit the brakes. Apparently, the flight leader realized what was about to take place and immediately applied heavy braking. Although both aircraft still appeared to be doing about 70 knots, the flight leader managed to make a left turn onto 21L and parallel his wingman, who by now was no more than 25 feet away. Fortunately, neither aircraft left the hard surface or made contact with the other, and the only damage sustained by either aircraft was two blown tires on the flight leader's aircraft.

Needless to say, the potential for disaster was there, and there was little doubt as to who was at fault. Believe me, it is not a good feeling to know what might have happened because I **assumed** I knew what the pilot was going to do instead of asking to make sure. Stay alert and **don't assume anything!** This awareness applies to pilots as well as controllers. ◄

Airfield Profile No. 11

MCAS Beaufort (NBC)

By Capt Jerry Pendzick, USMC

MCAS Beaufort or "Fightertown East" is the home of Marine Aircraft Group-31, 2nd Marine Aircraft Wing. MCAS Beaufort is also the home of Beaufort SAR, one of the finest search and rescue divisions on the east coast.

Airfield. MCAS Beaufort (Merritt Field) is a category B airfield having two intersecting runways. Runway 04/22 is 12,200 feet by 200 feet, and Runway 14/32 is 8000 feet by 200 feet. The primary instrument landing runway is Runway 22. Runway 22 is equipped with high-intensity edge lights, centerline lights, ALSF-1 approach lights with strobes, and a simulated carrier deck.

Facilities. MCAS Beaufort can accommodate all Fleet aircraft, as well as civilian aircraft. Normal flight operating hours are 0700-2300 Monday through Friday, 0800-1600 Saturday, and 1200-2000 Sunday. Hot-pit refueling (JP5) is available during field operating hours, as well as truck fuel (JP4 and JP5). Transport aircraft pit refueling can be arranged with prior coordination. An extremely limited transient maintenance capability is available at MCAS Beaufort. Follow-me vehicles, hot brakes, high power turnup, and compass rose areas are available for those in need.

All aircraft will be handled in accordance with Stage II Radar procedures, unless otherwise requested. MCAS Beaufort offers ASR/PAR, and High and Low TACAN approaches. Departures are normally via radar vectors. A SID is available for departures to the north, if desired. The airport traffic area is relatively free of obstructions, but a 1334-foot television tower is located 15 nm northeast of the field. Organizations requiring multiple instrument approaches for training purposes are highly encouraged to utilize MCAS Beaufort, IMC or VMC. Transient pilots flying repetitive sorties within the local flying area (350 nm), and using MCAS VAL (visiting aircraft line) or fuel pits for turnaround, must coordinate with the MCAS Operations Department. When ceiling and visibility are at or above 3000/3, pilots, at their request, may be vectored to the 5-mile initial point at 2500 feet and cleared for a visual approach via the overhead traffic pattern. When weather is below 3000/3, these requests will not be honored. A left break shall be utilized on all runways except Runway 32. Fifteen hundred feet shall be maintained until the break point; 1000 feet shall be maintained until the 180-degree position. Formation flights entering the "break" are limited to five aircraft.

Special Precautions. MCAS Beaufort is currently undergoing extensive renovation of its taxiways and runways. Construction will affect the usable length of the runway, so be sure to check NOTAMs and watch for illuminated construction barriers. Migratory birds pose a special problem for MCAS Beaufort from October-April. E-28 bidirectional arresting gear is available on the approach end of each runway. Each overrun is equipped with an E-5 chain gear. Three runways are normally equipped with OLS (fresnel lens). Runway 04/22 and the parallel taxiways are stressed to handle up to 800,000 pounds of weight for twin-delta, tandem landing gear configured aircraft. Specific weight bearing characteristics for all landing gear configurations are available in the IFR Enroute Supplement. The southern half of Taxiway 04/22 has several obstructions which may not meet wingtip clearance for certain transport aircraft, so check the supplement before you launch into Beaufort.

Aircrew Facilities. MCAS Beaufort has no base taxi service; base transportation is extremely limited; and transportation for prolonged use by deployed units is only available with prior coordination. Adequate BOQ, SNCO/ CPO, and BEQ spaces are available for RON use or prolonged TAD/TDY use. The MCAS Airfield Operations building has an excellent snack bar facility for use on roundrobin flights. (Hours of operation are 0730-2000 Monday through Friday, 0800-1600 Saturday.) MCAS Beaufort welcomes everyone to come and enjoy the outstanding hunting, fishing, and shrimping which make this air station a sportsman's paradise, as well as a fine air facility. ◄

Overhead MCAS Beaufort

Power settling vs Settling with power

By LCDR R. Prestridge
HSL-32 Safety Officer

WHAT is the difference between power settling and settling with power? The answer depends upon the aviator you talk to or the aerodynamics expert whose publications you prefer to read. The generally accepted Fleet definitions are:

Power Settling. Aerodynamically, the rotor is operating in a near-zero rotor thrust condition. We have a condition in the rotor in which air is flowing upward at the root and tip of the blades with air flowing downward at the center of the blades. This condition is "the vortex ring state," in which rotor thrust approaches zero. This condition is sometimes described as settling in your own downwash. (See Fig. 1.)

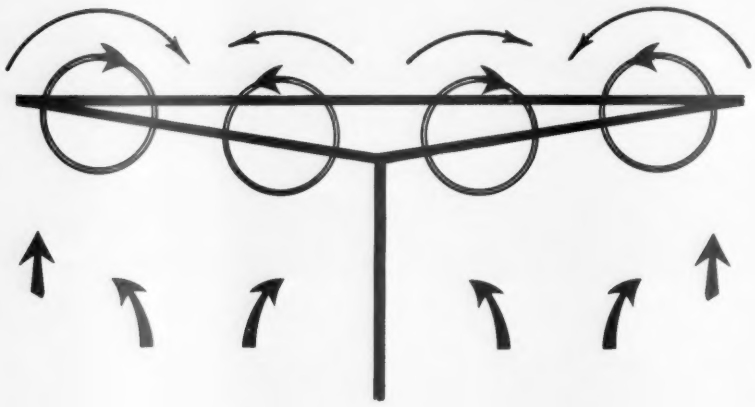


Fig. 1

Airflow through rotor system in the "vortex ring state."

Settling With Power. An attempt is made to operate the helicopter beyond its capabilities. Power required exceeds power available.

Most helicopter NATOPS manuals contain cautions about power settling (vortex ring state), telling aviators to avoid flight conditions which may cause such a condition. You are warned that: "Flight conditions causing power settling should be avoided at low altitudes because of the attendant loss of altitude necessary for recovery." You are further told that recovery is best accomplished by increasing forward speed and decreasing collective pitch. Thus, we are told how to recover but not how to avoid the vortex ring state (akin to a doctor who can cure a disease, but knows nothing of preventive medicine).

Sure there are some general statements about how the vortex ring state may occur at high density altitudes, high gross weights, and descending powered flight. Does this mean that SAR helicopters at NAS Fallon should not fly during June, July, or August, that helo flight training should not be conducted during these months, or that NAS Roosevelt Roads, Cubi Point, and similar duty stations are unsafe for helo operations due to high temperatures and correspondingly high density altitudes? The answers to the preceding questions are NO. Just as the fixed-wing aviator must adjust takeoff roll during conditions of high gross weight and/or high density altitude, helo drivers must avoid parameters which will contribute to the vortex ring state.

But, and this is a big BUT, most NATOPS manuals offer no guidance on which conditions or flight envelopes to avoid in order to remain clear of the vortex ring state.

This information gap is filled by George H. Saunders in his *Dynamics of Helicopter Flight.* Saunders not only gives an understandable explanation of the vortex ring state, but he further shows that "the vortex ring state can be completely avoided by descending on flightpaths shallower than about 30 degrees (at any speed). Furthermore, for steeper approaches it can also be avoided at sufficiently fast speeds. What is happening in both cases is that the turbulent wake created by the vortex systems is not remaining in the vicinity of the rotor and causing difficulty. At very shallow descent angles, the wake is shed mostly behind the helicopter. At steep angles, it is below the helicopter at slow rates of descent, and above the helicopter at high rates of descent (autorotation).

In summary, the following flight conditions are contributing factors to the vortex ring state:

- Vertical rates of descent greater than approximately 700-800 FPM (but less than autorotational rate of descent) with little or no forward airspeed.
- Saving the "power pull" for the last few feet of an autorotation, "cut gun," or steep approach instead of gradually slowing the rate of descent.
- Overshooting or getting ahead of the glideslope on a precision or steep approach. To salvage such an approach it is necessary to decrease collective and set up a high rate of descent while decreasing forward speed.

So, if you are a helo driver, don't stop flying when density altitude and gross weight are high, just be aware of flight regimes to avoid in order to stay out of the vortex ring state. ◄

By the book!

THREE miles west of Point Loma, an H-46 from HC-11 was returning from a carrier with 20 passengers and its cargo, when the aircraft experienced an engine failure. The aircraft had begun a gradual descent in preparation for landing and was at 400 feet and 125 knots. Rotor RPM (N_r) immediately dropped to approximately 85 percent and the No. 2 generator dropped off the line. The copilot, ENS Steve Roach, lowered the collective and confirmed an engine failure as the aircraft commander, LT Jerry Haggerty, took control. LT Haggerty initiated a flare, which built the N_r back up, armed the emergency throttle, and stabilized the aircraft at 70 knots and 125 feet. Petty officers Nowak and Emmerson, hearing the engine unwind and the APP start, completed the emergency ditching procedures and kept the ICS clear for the pilots. An emergency was declared and LT Haggerty executed an uneventful running landing at NAS North Island, safely depositing his passengers on dry land instead of in the water. Well done to LT Haggerty and his fine crew.

LETTERS
to the editor

Re: "Winter Glitches and Gotchas"

NAS Meridian – Shortly after the FEB '80 issue of APPROACH hit the street, we received a phone call from CDR Lee Goewey at NAS Meridian in regard to the C-1 incident in the subject article. The article involved an unexplained loss of airspeed indications, in icing conditions, with an operable pitot heater. Through his years of flying experience, CDR Goewey experienced two such incidents himself, and both times solved the problem by using the *Aldis* lamp in the aircraft to apply heat at the base of the pitot mast. (A trick learned several years ago from his second mech, AD2 L. A. Taylor, while serving in VP-22.) Apparently, the ice that was being melted by the pitot heater was running back along the inside of the pitot tube and freezing just before the point where the pitot tube entered the interior (heated) portion of the aircraft.

• APPROACH thanks CDR Lee Goewey for this helpful tip. We hope it will help one of you out of a sticky situation someday!

Inflight Refueling Operations

Wilts, England – For some years I have been compiling material for a book on the history and development of air refueling.

I have a copy of the article "Tanker Techniques" by F. W. Burton in your SEP '67 issue, and I would like to request copies of any other articles or major news items on naval air refueling operations, fixed wing and helicopters, that have appeared in APPROACH. I am particularly interested in any aircraft rescues made possible by air refueling.

B. Gardner
23 Boness Road
Wroughton
Wilts SN4 9DX
England

• All of our information on inflight refueling is on its way to Mr. Gardner. Many of you readers may have some interesting information or stories about inflight refueling incidents as well. They should be mailed to Mr. Gardner at the address listed.

What Can We Say?!

St. Albans, NY – We have inquired at the U.S. Naval Institute, Annapolis, MD as to what has been done in recent years to improve air safety in regard to our aircraft carriers.

In a letter from the Institute, it is apparent that very little has been done, and the situation is worse than we expected.

After giving the matter some thought, we have concluded that probably the most important thing that should be done is to find some way to reduce the speed of incoming planes.

Other than that, it has occurred to this writer that the next best thing to do is to install long, 16-feet wide, rubber mats on rollers, to be able to have the mats moving in the opposite direction of the incoming aircraft.

To be more explicit, we all know how difficult it is to try to ascend a down-moving escalator. By the same token, an incoming plane, instead of landing on a steady deck, would land on a mat moving rearward, or a series of rolling mats, which would, in effect, slow down the incoming plane.

We would suggest that the Navy call in the Goodyear Rubber Company, and have their consultants experiment on small models to see which methods and type of mats (or belts) are most effective for planes to land on.

It would be possible to speed up the belts to a very high speed to compensate for the speed of the incoming plane.

Then, too, if the belt or mat had cleats on it, the "braking effect" would be greater.

Whether a very long, moving belt would be more effective than, say, a series of 50-yard-long belts would have to be determined by trial and error.

Shorter belts could attain higher speeds than a very long one, and they could be shut off quicker. If the belt is not slowed down quick enough, it could throw the plane back over the rear of the boat, into the water.

Well, this idea will not solve the safety problem by itself, but it will go a long way. For this idea, send me one check for $158.40 and another for $111.60. Thank you. I shall be working on other ideas to improve the safety of landing planes.

R. M. Stepteau

• We literally cannot wait to see your next idea! ◄

Help Wanted!

APPROACH Fixed Wing Writer/Editor

Technical Publications Writer – Editor (Aviation Safety) GS-1083-9. Salary $17,035. Position is located at Naval Safety Center, Norfolk, Virginia. Work involves research, and writing and editing of articles from short fillers to full length features on aviation safety and other associated matters for APPROACH Magazine. Position requires 3 years of progressively responsible work which has required an understanding of the basic concepts and practices in aviation safety, plus 2 additional years of experience as a writer/editor/technical report writer which has required substantial knowledge of fixed wing tactical jet aircraft operations and environment. Contact Mr. Hudson at (804) 444-7541 (Autovon 690-7541). Equal Opportunity Employer.

APPROACH welcomes letters from its readers. All letters should be signed though names will be withheld on request.

Address: APPROACH Editor, Naval Safety Center, NAS Norfolk, Va. 23511. Views expressed are those of the writers and do not imply endorsement by the Naval Safety Center.

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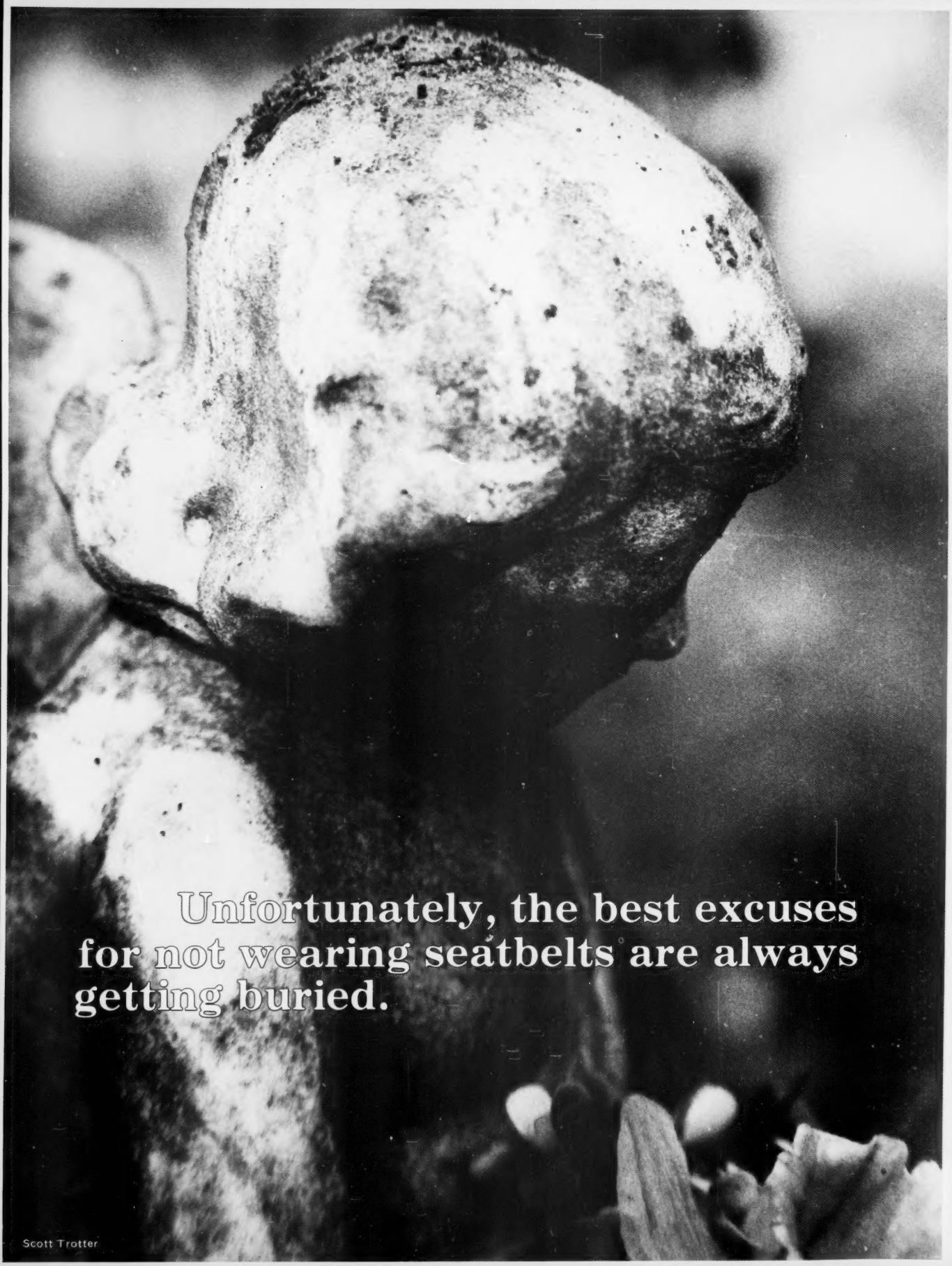
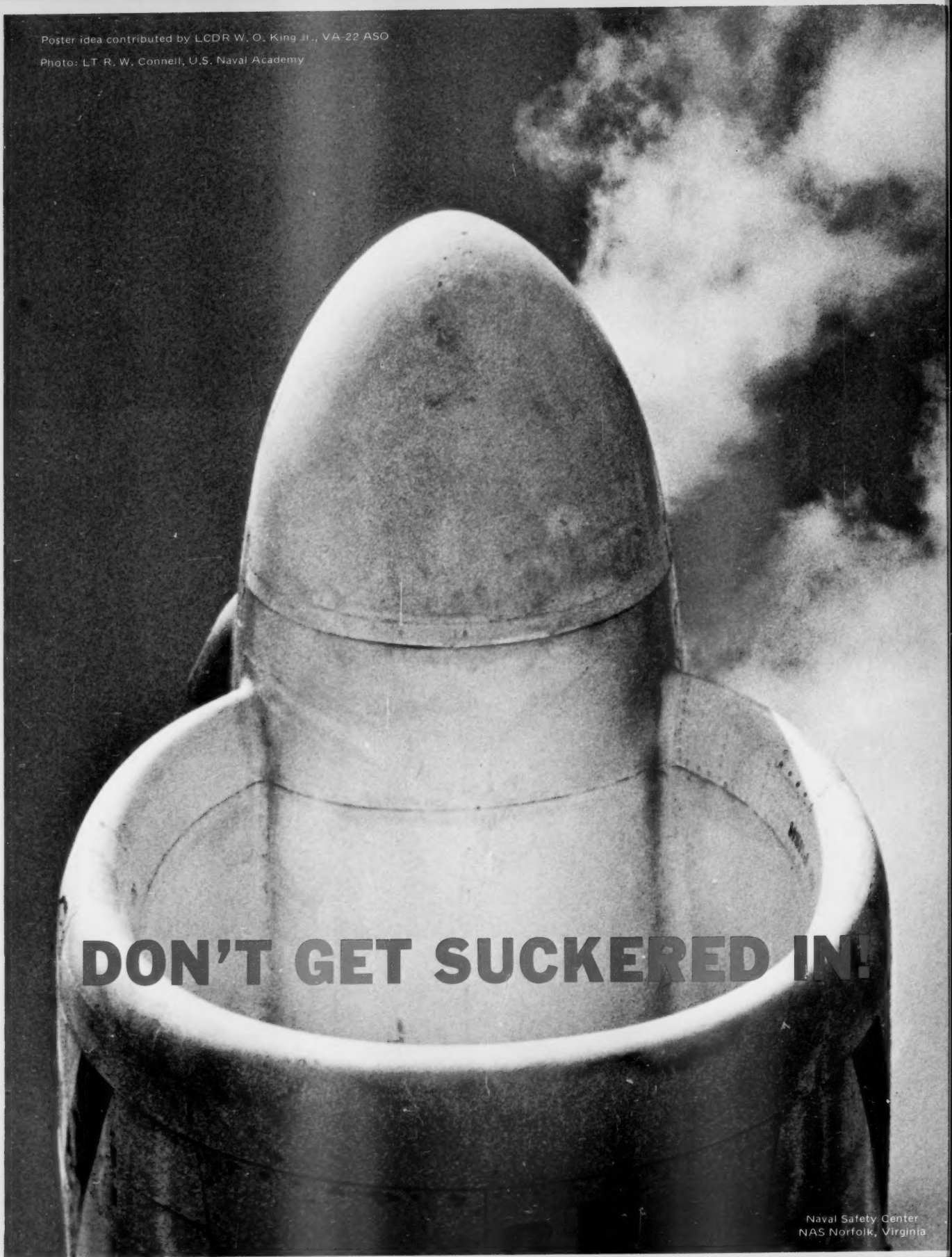

Unfortunately, the best excuses for not wearing seatbelts are always getting buried.
Scott Trotter


Poster idea contributed by LCDR W. O. King Jr., VA-22 ASO
Photo: LT R. W. Connell, U.S. Naval Academy
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